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2001

EPA Superfund
Record of Decision:

KENNECOTT (SOUTH ZONE)
EPA ID: UTD000826404
OU 03, 06, 07
COPPERTON, UT
09/28/2001

RECORD OF DECISION

KENNECOTT SOUTH ZONE SITE

Lark Waste Rock and Tailings (OU6)
South Jordan Evaporation Ponds (OU7)
Butterfield Mine, Butterfield Canyon and Herriman (OU3)

September 28, 2001

U. S. Environmental Protection Agency
Region 8
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Denver, CO 80202

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BUTTERFIELD MINE, BUTTERFIELD CANYON, and HERRIMAN (OU 3)

PART 1: THE DECLARATION

A. Site Name and Location

This decision document covers all of three (3) operable units which are part of the Kennecott South Zone which was proposed for the National Priorities List. Included are Lark Waste Rock and Tailings (Operable Unit 6), South Jordan Evaporation Ponds (Operable Unit 7), and Butterfield Mine, Butterfield Canyon, Herriman Residential Soils, and Herriman agricultural soils (Operable Unit 3). These sites are located in unincorporated Salt Lake County, Utah, the City of South Jordan, Utah, and the Town of Herriman, Utah.

B. Statement of Basis and Purpose

This decision document presents the selected remedial action for the Lark Waste Rock and Tailings, South Jordan Evaporation Ponds, and Butterfield Mine, Butterfield Canyon, Herriman residential soils, and Herriman agricultural soils Operable Units of the Kennecott South Zone Site located in Salt Lake County, Utah, which was chosen in accordance with CERCLA (42 U.S.C. §9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 C.F.R. Part 300). This decision is based on the administrative record for this site.

The State of Utah concurs with the selected remedy.

C. Assessment of Site

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

D. Description of Selected Remedy

Most of the areas covered by this decision document were addressed in previous cleanup projects and require no further action. These areas include OU 6 (Lark Waste Rock and Tailings), OU 7 (South Jordan Evaporation Ponds), and, except for the agricultural lands near Herriman, most of OU 3 (Butterfield Mine, Butterfield Canyon, and Herriman). At OU 6, OU7 and upstream locations of OU3, wastes containing significant levels of hazardous substances were removed from the sites and stored in a nearby engineered repository. Waste rock with acid generating potential was also removed from these operable units to a location protected by a leachate collection system. Remaining wastes were covered with a soil cap and then revegetated. In the residential sections of Herriman (part of OU3), soils tainted with lead exceeding a concentration of 1200 mg/kg were excavated down to a maximum of 18 inches, replaced with clean fill and top soil and revegetated. The excavated soils were transported to a nearby engineered repository. EPA hereby determines that such removal actions shall constitute final remedial actions for these areas.

Alternative 2, Institutional Controls, is EPA’s Selected Remedy for only the Herriman agricultural lands portion of the site. The other parts of the site covered by this Record of Decision have already been addressed as previously described. The Selected Remedy for the Herriman agricultural lands includes the following elements.

Suggested for the agricultural lands within the incorporated boundaries of the City of Herriman (Note that land use and building protocols are a local government function, and the specific elements are given only as possible approaches; the actual plan is at the

discretion of the city):

- Development of a land use plan for the contaminated agricultural lands which maximizes non-residential land use in accordance with the objectives of the community's vision for future growth needs (this element has already been developed by the Herriman Residents for Responsible Reclamation in conjunction with the property owners and adopted as an appendix to Herriman's Master Plan);

- Passage of a city zoning ordinance which implements the land use plan for the contaminated properties;

- Design of a protocol for content of subdivision applications and site development plans which includes requirements that developers submit plans on how contaminated soils will be managed (in addition to normal elements of site development plans);

- Development of special building permit provisions which specify how contaminated soils unearthed during construction will be managed (in addition to standard provisions of the building permits);

- Passage of a city ordinance or resolution which describes the clean up levels required for different land uses within the city;

- Installation of the necessary information management systems for review and analysis of applications consistent with this remedy;

- Notification to affected public works departments, irrigation companies, and utility infrastructure location services of the locations where contamination is likely to be found in the Herriman.

Suggested for the Herriman agricultural lands within unincorporated Salt Lake County: (Note that land use and building protocols are a local government function, and the specific elements are given only as possible approaches; the actual plan is at the discretion of the county):

- Development of a land use plan which maximizes non- residential land use within the contaminated areas to the extent compatible with the land use vision of the county for this area (this has been completed by the Herriman Residents for Responsible Reclamation). The County can choose to adopt this land use plan, or remain with the current county land use plan and zoning.

- Development of site-specific cleanup standards for the Herriman agricultural lands (perhaps as adopted by the City of Herriman) or, alternatively, a county-wide cleanup standard for all lead and arsenic sites in the unincorporated county which can also be used at Herriman.

- The county could develop site development plan review procedures and building permit requirements for its own evaluation of new developments in the Herriman area (and other similar sites). Herriman's review procedures can be adopted if desired.

E. Statutory Determinations:

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the Remedial action, is cost-effective, and utilizes permanent solutions to the maximum extent practicable. The remedy in these OUs does not satisfy the statutory preference for treatment as a principal element of the remedy because treatment of metals in mining wastes typically increases the volume of the waste without reducing toxicity or mobility. Because this remedy will result in hazardous substance remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or

will be, protective of human health and the environment.

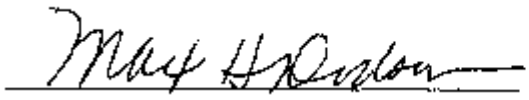
F. ROD Data Certification Checklist

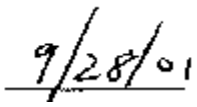
The following information is included in the Decision Summary of this Record of Decision. Additional information can be found in the Administrative Record file for this site:

- Chemicals of concern and their respective concentrations;
- Baseline risk represented by the chemicals of concern;
- Cleanup levels established for chemicals of concern and the basis for these levels;
- How source materials constituting principal threats are addressed;
- Current and reasonably anticipated future land use assumptions;
- Potential land use that will be available at the site as a result of the Selected Remedy;
- A discussion of costs;
- Key factors that led to selecting the remedy.

G. Authorizing Signature(s)

The following authorized official at EPA Region VIII approves the selected remedy as described in this Record of Decision.





Max H. Dodson
Assistant Regional Administrator
Office of Ecosystems Protection and Remediation
U. S. Environmental Protection Agency, Region VIII

Date

PART 2: DECISION SUMMARY

SECTION 1: INTRODUCTORY INFORMATION RELEVANT TO ALL OPERABLE UNITS ADDRESSED IN TIES DECISION

A. Site Names, Locations, and Descriptions

1. *Name and Location*: This decision document covers all of three (3) operable units which are part of the Kennecott South Zone Site proposed for the National Priorities List. Included are Lark Waste Rock and Tailings (Operable Unit 6), South Jordan Evaporation Ponds (Operable Unit 7), and Butterfield Mine, Butterfield Canyon, Herriman Residential Soils, and Herriman agricultural soils (Operable Unit 3). These sites are located in unincorporated Salt Lake County, Utah, the City of South Jordan, Utah, and the Town of Herriman, Utah. The general location of these sites is given on Figure 1.

2. *Identification Numbers*: The locations and CERCLIS numbers are given in the following table:

TABLE 1
CERCLIS IDs and Location of Sites

Site name	CERCLIS	Location
Kennecott South Zone	UTD000826404	Southwestern Salt Lake County, Utah
Lark Tailing (OU6)	UTD980959258	Unincorporated Salt Lake County, Utah, west of Cities of Riverton and Herriman
State Motorcycle Park (OU6)	UTD980959233	Unincorporated Salt Lake County, Utah, west of Cities of Riverton and Herriman
Kennecott Evaporation Ponds (OU7)	UTD988070686	Western part of the City of South Jordan
Butterfield Mine (OU3)	UTD981548993	Unincorporated Salt Lake County, Utah, west of City of Herriman
Butterfield Creek - Herriman Residential Soils (OU3)	UTD0002055176	City of Herriman

3. *Lead and Support Agencies and Sources of Funding*: A summary of the agencies' roles and source of funds is given in the following table:

TABLE 2
OVERSIGHT AND FUNDING OF CLEANUPS

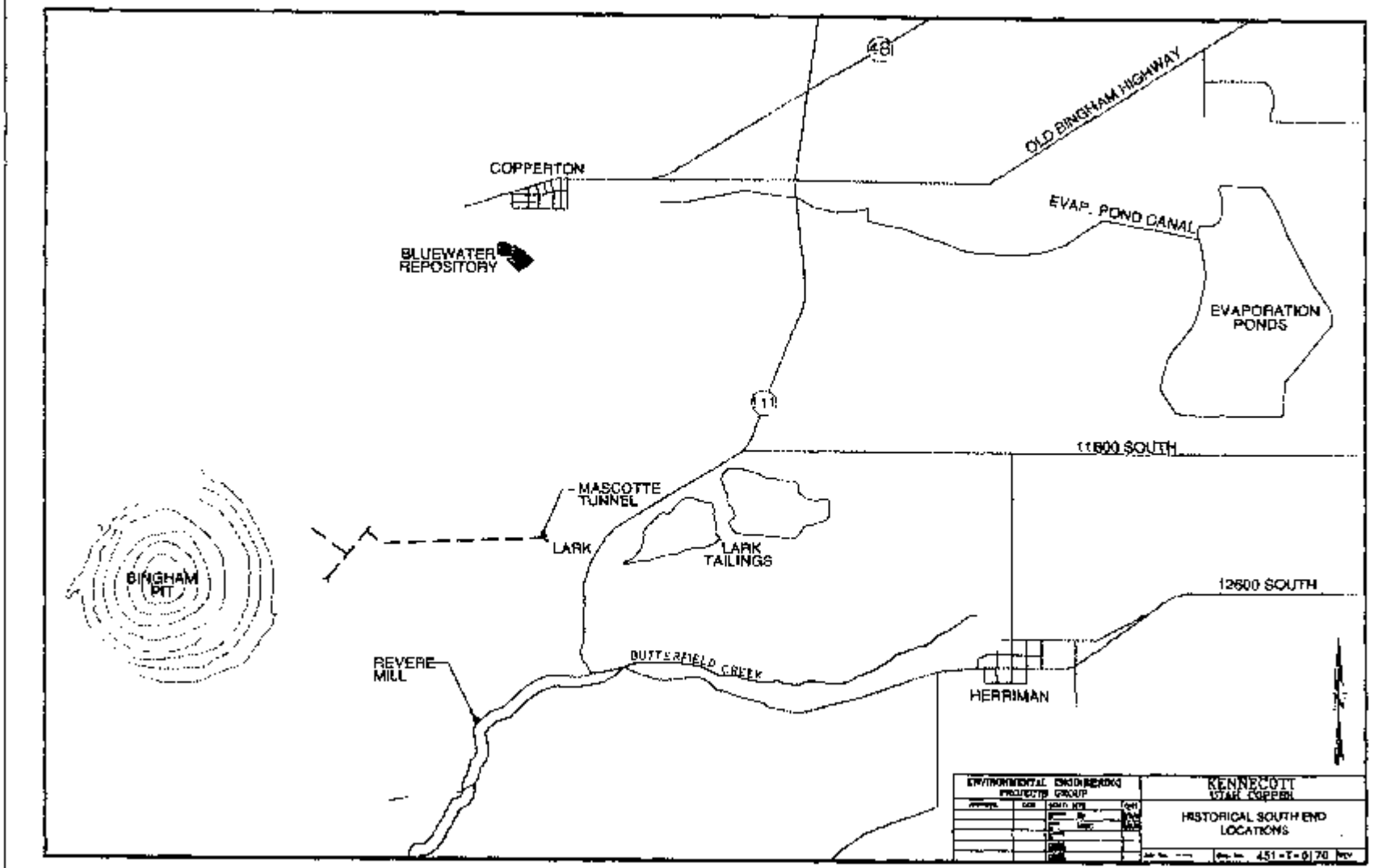
Site Name	Lead and support agencies	Source of funding
Lark Waste Rock and Tailings (OU6)	Lead = USEPA Support = UDEQ	PRP (Kennecott Utah Copper Corp)
South Jordan Evaporation Ponds (OU3)	Lead = USEPA Support = UDEQ	PRP (Kennecott Utah Copper Corp)
Butterfield Mine (OU3)	Lead = USEPA Support = UDEQ	PRP (Kennecott Utah Copper Corp)
Butterfield Canyon (OU3)	Lead = USEPA Support = UDEQ	PRP (Kennecott Utah Copper Corp)
Herriman Residential Soils (OU3)	Lead = USEPA Support = UDEQ	Fund lead with services provided by Kennecott Utah Copper Corp.
Herriman Agricultural Soils	Lead = USEPA Support = UDEQ	Fund lead
History Sites (Onsite)	Lead = UDEQ Support = USEPA	PRP lead (Kennecott Utah Copper) under terms of MOU)
Historic Sites (Offsite)	Lead = UDEQ Support = USEPA	Fund lead

B. Community Participation

The Proposed Plan for this overall action was mailed to local residents on April 25, 2001. Prior to the mailing of the Proposed Plan, EPA and UDEQ offered to give a summary of the contents to each of the city councils involved. The Herriman City Council was briefed on April 19, 2001. South Jordan did not believe a briefing was necessary because they were already familiar with the cleanups in their city. Representatives from the district attorney, health department, and engineering department of Salt Lake County were briefed on the status of this action on the unincorporated areas on April 9, 2001. Elected officials and water suppliers participated in a tour of the cleanup sites on May 8, 2001. The public comment period was originally April 30, 2001 to May 30, 2001. A written request for a 30 day extension was received by EPA and the public comment period was extended until June 29, 2001. An advertisement in the Salt Lake Tribune announcing the public hearing appeared on April 30, 2001, and public hearings were held on May 9, 2001, at the Herriman Elementary School, and on May 10, 2001, at South Jordan City Hall. The oral and written comments received by EPA during the public hearings and during the public comment period are given in the Responsiveness Summary. Both daily newspapers and the local weekly carried stories about the Proposed Plan.

C. Scope and Role of the Proposed Action

This action covers OU3, OU6, and OU7 of the Kennecott South Zone site. This Record of Decision is the final decision at the Kennecott South Zone Site. The first ROD at the


48
OLD BINGHAM HIGHWAY
COPPERTON
EVAP. POND CANAL
BLUEWATER REPOSITORY
EVAPORATION PONDS
11
11800 SOUTH
MASCOTTE TUNNEL
LARK
LARK TAILINGS
BINGHAM PIT
12600 SOUTH
REVERE MILL
BUTTERFIELD CREEK
HERRIMAN
ENVIRONMENTAL ENGINEERING PROJECTS GROUP
KENNECOTT UTAH COPPER
HISTORICAL SOUTH END LOCATIONS
451-T-0170

Kennecott South Zone site in 1998 covered the surface wastes in the Bingham Creek area and other facilities in the northern portion of the site. The second ROD at the site in 2000 covered the selected remedy for the ground water contamination which underlies the site. This present document is the third ROD and covers the surface wastes found in the Butterfield Creek area and other facilities in the southern portion of the site. The previous cleanups described in this document were performed by Kennecott and/or EPA using Time- Critical Removal authorities. In some cases Operation and Maintenance activities will be performed by the Responsible Party using state permitting authorities (ground water permit, NPDES (National Pollutant Discharge Elimination System) permit, DOGM (Utah Division of Oil, Gas and Mining) mine operating permit, etc.). In other cases, long term management will be provided by local (city or county) zoning ordinances and building permit requirements.

D. Summary of Site Risks

1. *The Site Conceptual Model*:

The Site Conceptual Model is given in Figure 2. The totality of ways mining affects the environment is so complex that the schematic in Figure 2 represents only the major pathways present at these OUs.

During the process of mining, open pit and underground miners encounter two kinds of rocks. Rock, with sufficient metal content to justify the cost of milling is called ore. However, to get at the ore, other rocks with poor metal content have to be moved. This material is called waste rock. Ore is excavated and sent to a mill. There are several examples of this at the sites covered in this document. One example is the Ohio Copper operation. Ohio Copper, and later United States Smelting Refining and Mining Co.(USSRM), excavated ore from their underground mines and hauled it out the Mascotte Tunnel to their mill on the Lark site. At the mill, the mineral was separated from host rock by grinding and then gravity separation or flotation. There are two fractions. The fraction containing the metals is called concentrate and the barren fraction is called tailings. Since there were no smelters on site, the concentrates were shipped, typically by rail, to smelters located in Salt Lake Valley. The tailings were simply slurried to a site near the mill. The dump sites of the waste rock became known as Lark Waste Rock and the dump site of the tailings is now known at Lark Tailings. In another case, the Revere Mill on Butterfield Creek simply dumped their tailings into the creek, which carried the tailings to downstream areas.

The mining facilities had a number of ways to deal with their waste rock. For this reason, the schematic on the waste rock side of the chart can get complicated. Only the parts which are relevant and significant to this action are shown. Sometimes waste rock is simply discarded near the portal of the mine. Such was the case for the Lark Waste Rock dumps - waste rock was dumped into nearby gulches. In the case of the Butterfield Mine, the portal was so close to Butterfield Creek that the waste rock from that mine ended up in the creek.

Waste rock does have economic value in two ways - it is sometimes used in construction projects. For example, dikes of the South Jordan Evaporation Ponds were built with waste rock. Waste rock does have some metal content which miners like to exploit. Waste rock in this area has sulfides. When the sulfides are exposed to water and oxygen, sulfuric acid is formed. As the sulfuric acid percolates through the waste rock, it leaches metals out of the waste rock. This process is a natural reaction, but is and was often enhanced by miners seeking to maximize their recovery of economic values from the waste. Normally, miners will collect as much of the leachate as possible because of its metal content. However, in the case of the South Jordan Evaporation Ponds, during wet years, there was too much water and leachate for the miners to collect and store. Leachate from the main waste rock dumps and other stormwaters, sometimes neutralized, sometimes not, were directed to the Ponds.

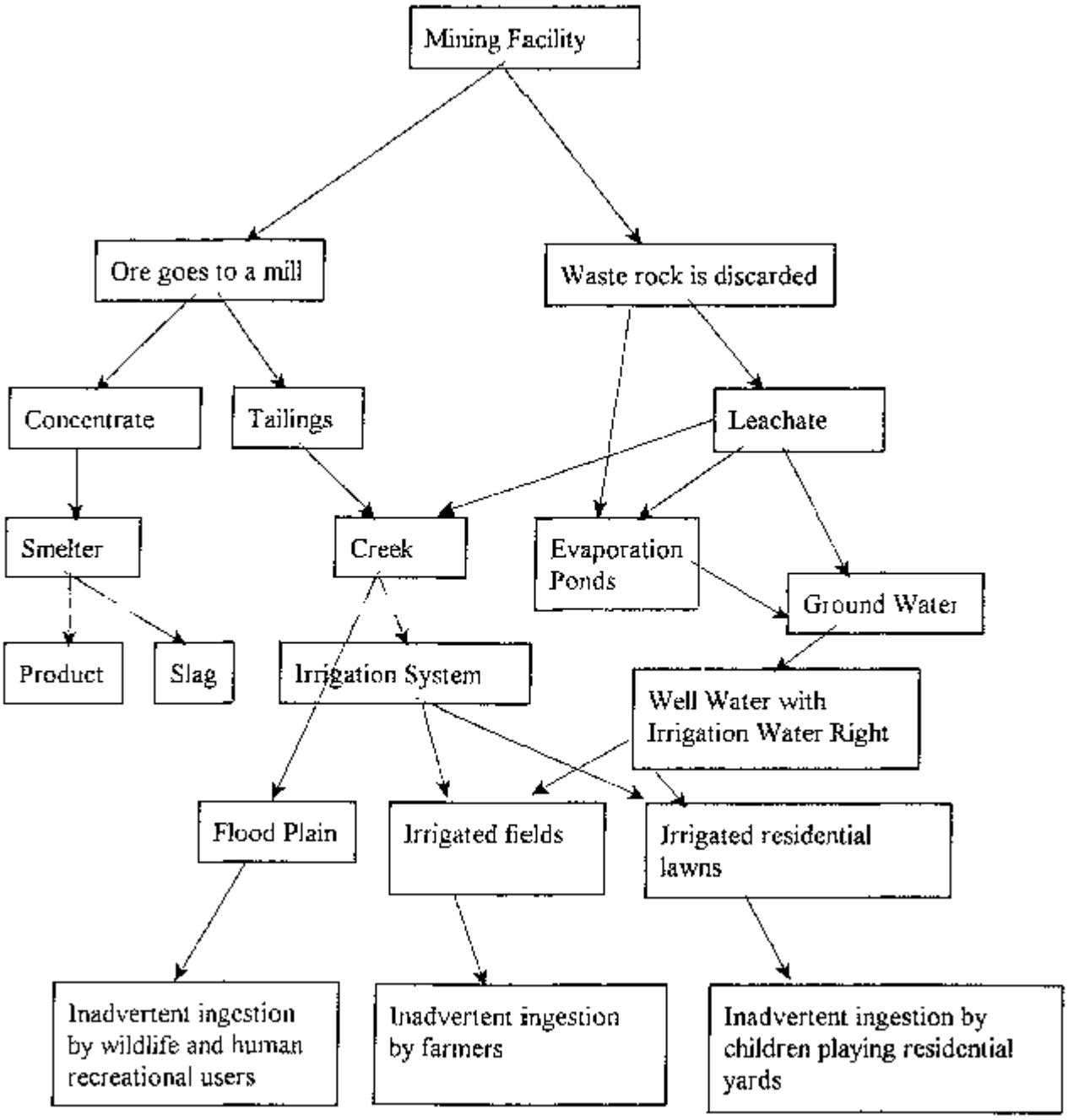


Figure 2
Site Conceptual Model

From there, the leachate waters percolated into the ground contaminating the ground water in the area. In another situation, leachate from a mine tunnel was directed to Butterfield Creek where it was then used for irrigation.

In summary, any wastes dumped into the creek or onto the ground could find their way to water users in the valley. In recent times, the water was used primarily for irrigation. It was the goal of the various removal projects to break the significant exposure pathways.

2. Exposure pathways:

The most significant exposure pathway depends on the land use. In a residential setting, young children are the most sensitive population. EPA uses the IEUBK model which predicts the blood lead distribution in children aged 0-7 years. The most significant exposure pathway in that model is typically inadvertent ingestion of lead- tainted soils through young children putting dirty hands or toys in their mouths. In a commercial, industrial, or agricultural setting, adults are the primary users, and pregnant women are the most sensitive population. In this case, EPA uses the Interim EPA Adult Lead Model which predicts blood lead distribution of lead in fetal blood. In those settings, both inadvertent ingestion and inhalation of lead tainted dusts and soils are important.

3. Summary of site specific studies:

An intensive effort to determine site- specific information for use in EPA models was conducted as part of an earlier action at Bingham Creek. The studies at Bingham Creek were designed to be applicable to other areas of the Kennecott South Zone Site. The form of the lead in Herriman is similar to the form found at Bingham Creek. The method of deposition was similar and the weathering by agricultural use for many years was also similar. The studies conducted at Bingham Creek and used again for Herriman are:

1. Two vegetable uptake studies, one using vegetables grown by local gardeners using local conditions, and the other using vegetables grown under controlled conditions in a green house.

2. Uptake of lead and arsenic by wheat crops grown in a field with variable concentrations of lead and arsenic contamination.

3. Dosing of two composite soil samples to juvenile pigs in EPA’s Bioavailability Studies using juvenile pigs as a surrogate for human children.

4. Blood lead study which also included indoor dust determinations (conducted by the University of Cincinnati),

Site specific to Herriman was another blood lead study (conducted by the University of Utah) speciation of lead and arsenic compounds in the Herriman soil and Butterfield Creek sediments to compare with analogous samples from Bingham Creek, interviews with local residents to determine the duration and frequency of exposures, and interviews with local residents to determine the types of recreational activities practiced in Butterfield Canyon upstream of the town.

4. Use of models:

To determine the acceptable concentrations of lead in soils in a residential setting, the IEUBK model was used with as much site specific information as available and default values for the remainder. The assumptions and methods used are available in the Herriman Residential Soils Endangerment Assessment (1997).

To determine the acceptable concentrations of lead in soils in commercial, industrial, and agricultural settings, the Interim EPA Adult Lead Model was used, again with as much site specific information as available and default assumptions for the remainder. The assumptions and methods used are available in the Non Residential Preliminary Remediation Goals for the Kennecott site and the companion document Risk Management Principles for the Non - residential Soils at Herriman.

5. Ecological risk assessment:

Two Ecological Risk Assessment studies were conducted by Kennecott. The first, Ecological Risk Assessment of the Northern Oquirrh Mountains (1996), examined a wide area of the canyons and mountains comparing the concentrations of contaminants in soils and plants to literature describing the effects on various types of flora and fauna. Expanding on the initial effort, Kennecott conducted a follow up study specifically addressing the conditions in Butterfield Canyon, Butterfield Canyon Ecological Risk Assessment (1997).

By this time, the Lark Waste Rock and Tailings Operable Unit and the South Jordan Evaporation Ponds Operable Unit had already been addressed and the only remaining contamination which could affect the ecology of the area was located in the Butterfield Canyon and Herriman areas. Because the Herriman land is used for residential and agricultural purposes, it is not a wildlife habitat area. Butterfield Canyon, on the other hand, is open space and is prime riparian habitat.

There were three areas of specific interest in Butterfield Canyon because of their high lead concentrations: Revere Mill site along the creek, Yosemite Gulch, and Queen Mine up Black Jack Gulch. The Revere Mill site and Yosemite Gulch had a diverse ecosystem of plants which did not appear to be stressed by the presence of the lead. The risk assessors speculated that this was because the bioavailability of the lead to the plants was low. This area was, nevertheless, cleaned up because of its proximity to the creek and the potential of the wastes to wash downstream in heavy storms. The wastes at Queen Mine do not support vegetative growth and this area is essentially barren of plants. The absence of plants could be due to the metal content of the wastes or the acid content or both in conjunction. However, the size of the barren area is about 2 acres and the size of the canyon is on the order of 20 square miles. The impact of this area, remote from water sources, and small in comparison to the habitat, is inconsequential.

At the soil concentrations observed, the only animals which might be impacted at some locations in the canyon were horses and shorebirds. Given the relationship between forage and soil concentrations, the literature would suggest that the No Observed Adverse Effects Level (NOAEL) for horses would be equivalent to a horse grazing 100% of the time on grass grown in soils containing 2500 mg/kg lead. In Butterfield Canyon, this level of lead is uncommon since the contaminated soils were removed from the valley near the creek. Since the visits of horses and their riders are only occasional, no impacts are expected in the canyon for horses. Shorebirds are rare since there is no nearby shore.

Although the ecological risk assessment suggested that the ecosystem was not at risk due to the presence of metals in Butterfield Canyon, the exercise pointed out one extra area of concern. It is common for Herriman residents to own horses and equestrian activities are popular. Although horses are only occasional visitors to Butterfield Canyon, their pastures and corrals are sometimes located in the contaminated Herriman agricultural lands. Although not technically wildlife in the traditional sense, protection of horses while they graze in Herriman pastures or visit Butterfield Canyon is important. Lead concentrations exceeding 2500 ppm in the unremediated soils of Herriman agricultural areas are not uncommon.

A further investigation in the ecological risk assessment revealed that, although

the No Observed Adverse Effects Level (NOAEL) is on the 2500 mg/kg in soil, the Lowest Observed Adverse Effects Level (LOAEL) is about 10.8 times higher at 27,000 mg/kg. This means that adverse effects of lead on horses have been observed in the literature beginning at 27,000 mg/kg in soil; however, effects at 2500 mg/kg in soil are theoretically possible. Since no reports of lead impacts on horses in the area have been reported in recent times, and there is a safety factor of 10, horse grazing on Herriman agricultural lands does not pose an observed risk. There are no concentrations of lead as high as 27,000 mg/kg at the surface in the Herriman agricultural lands,

No past or future cleanups of soils in the Butterfield Canyon, Lark, South Jordan and Herriman areas were needed solely on the basis of reduction of ecological risk. However, some of the cleanups did present opportunities to improve the quality of the habitat in the course of the cleanup.

E. Remedial Action Objectives

The Remedial Action Objectives for this action are as follows:

1. Prevent ground water contamination from uncontrolled releases of acids and metals leached from waste rock piles

2. Prevent exposures of humans to unacceptably high levels of lead and arsenic in soils, based on different exposure rates at different land uses.

3. Prevent downstream migration of unacceptable levels of lead and arsenic in waters used for irrigation by homeowners and farmers.

4. Protect flora and fauna in areas which are prime wildlife habitat.

DECISION SUMMARY
SECTION 2: LARK WASTE ROCK AND TAILINGS (OU6)

A. Site Name, Location and Description

1. Site type and description of operable unit:

Lark Waste Rock and Tailings (OU6) includes areas in and near the former town of Lark which were contaminated by wastes generated by mining activities in the vicinity. Wastes included waste rock from digging the tunnels and shafts of the mines, tailings generated by several mills, and acid mine drainage discharged onto soils and into holding ponds, The area covered by tailings was about 470 acres; waste rock was deposited on about 40 acres; and another 200 acres was affected by mine drainage. It was estimated that there were about 5 million tons of tailings and 2 million tons of waste rock present on the site. The site is transected by two intermittent streams, Midas Creek and Copper Creek, neither of which normally contain water. Also present on the site is a small wetlands fed by a seep of moderately contaminated water.

2. Facilities located within OU6

Within OU6 are the locations of several historic mining and milling operations and waste deposits from these operations. They are: Proler, Dalton and Lark Railroad, three Ohio Copper Company Mills, Fortune Mill, New Mammoth Mill, Dalton and Lark Mill, Mascotte Tunnel, Mascotte Ditch, Mascotte Pond, Mascotte Tailings, Midas Creek, Midas Creek Silo Area, Lone Tree Tailings, State Motorcycle Park (Lark Tailings), Lark Waste Rock, Randolph Peterson Gate, Copper Creek and Gulch, Copper Gulch Mines, East Side Bingham Canyon Dumps, Midas Pond, Eastside Reservoir, Bingham Tunnel, and Old Bingham Tunnel.

B. Site History and Enforcement Activities

1. Activities at the site which led to contamination:

Mining activities began in the West Mountain (Bingham) Mining District in 1863. In the next 40 years, most of the mining was done in Bingham Canyon and the whole mountainside in that area became honeycombed with adits and shafts. Lead, silver and gold were the metals of most interest at the time, but around 1900 mining companies began to be interested in the copper ore as well. In 1901, the Bingham Consolidated Mining and Smelting Company drove an ore-haulage, drainage tunnel to drain their Brooklyn, Dalton, and Lark mines and haul ore to a railroad spur located near the tunnel portal. The tunnel, called Mascotte Tunnel, was later extended to intersect with the Ohio Copper Company’s ore body in Bingham Canyon and serve as a way to haul ore from that mine.

In 1909, the Ohio Copper Company began operating a mill located about 3/4 mile southeast of the Mascotte Tunnel portal at Lark. The mill had a capacity of 4,500 tons of ore/day. The mill burned in 1918, was rebuilt, and was dismantled in 1919. During its operation it is estimated that the mill processed about 7-8 million tons of copper ore. Tailings were slurried and discharged to a location near the mill.

In 1923, the Ohio Copper Company began experimentation with another form of copper recovery when they discovered that waters coming from the Mascotte Tunnel contain appreciable amounts of copper. The Ohio Copper Company had mined the area using a block-caving technique which had left depressions at the surface. Utah Copper Company was granted permission to fill these depressions with their own waste rock. Water draining through the waste rock leached copper from the waste rock and collected in the mine tunnels underneath. The Ohio Copper Company constructed launders in the tunnel to collect the water and precipitate the copper from the

drainage using scrap iron. Later, the Ohio Copper Company endeavored to increase the concentrations of copper in the water by spraying mine waters on the top of the waste rock dumps and even augmented the water with sulfuric acid in an attempt to increase recoveries. The copper precipitate (copper cement) was hauled out of the Mascotte Tunnel to the railhead near the portal. It was shipped to the Garfield Smelter for further processing. Eventually the leaching became ineffective and leaching operations were suspended in 1931.

In 1937, Ohio Copper Company erected a new mill about one mile north east of the old mill site to reprocess the tailings left by the earlier operation. This mill used a leaching - precipitation - flotation process. Water for the operation came from the Mascotte Tunnel. Operations ceased in 1947 when the old tailings were exhausted. Some of the properties were worked intermittently by leases until about 1950.

In addition to the tailings left by the Ohio Copper Company, there were ten dumps of waste rock in the Lark area. The waste rock dumps came from driving the Mascotte Tunnel and Ohio Copper Company mine (Long Dump), U. S. and Lark Mine (Miscellaneous Dump), Bingham Tunnel and Lark Mine waste rock (Round Dump).

In 1948, Kennecott struck an agreement with US Smelting Refining and Mining Company (USSRM) under which Kennecott drove the Bingham Tunnel for USSRM in exchange for property rights within Kennecott’s expanding pit. The new tunnel, built between 1948 - 1952, acted as a new entrance for the Lark Mine and other USSRM properties under upper Bingham Canyon. In 1952, the Herriman Irrigation Company began transporting water from the Bingham Tunnel to Herriman via a pipeline.

Kennecott bought the surface rights to USSRM’s Lark properties in 1962, and purchased the Bingham Tunnel in 1972. Today, Kennecott maintains the Bingham Tunnel as a way to dewater the Bingham Canyon pit. Transport of Bingham Tunnel water to Herriman ended in 1987. Today the water is diverted to Kennecott’s process water system. Both the Mascotte Tunnel drainage and the Bingham Tunnel drainage have been implicated in a plume of groundwater contamination originating in the area.

In 1977, Kennecott leased the land on which the waste rock and tailings were deposited to the Utah State Division of Parks and Recreation for use as a motorcycle park. The area looked like a sand dune area. It is estimated that 150-200 vehicles per day used the park on the weekends. The state closed the park and cancelled the lease in 1989 when areas with high lead concentrations were found.

There are several other areas near Lark which were also impacted by mining activities. The Mascotte Pond was used between 1920 and 1933 to serve as a settling basin for waters coming from Bingham Creek. The waters were used for irrigation. A ditch from the Mascotte Tunnel to the pond was built in 1942. Waters from the pond were then conveyed by the Bastian Ditch to farmland north of Herriman. The Mascotte Pond was located near the intersection of State Highway 111 and 11800 South. Another area, called the Mascotte Tailings or Randolph Peterson Gate Soils was a 200-300 acre area with red stained soils. It is thought that this area was contaminated when mine waters were diverted there sometime in the past.

Another small pocket of waste containing layers of tailings was found in an area called the Midas Creek Silos next to Midas Creek near its confluence with the Mascotte Ditch. A later study conducted by UDEQ found the rest of the Midas Creek sediments to have low levels of hazardous substances although the sediments and soils were sometimes discolored. At the southern end of the site, Copper Creek transects the area. Some pockets of wastes were also found in Copper Creek due to mining activities upstream. Also, there was a nearby field, named Lone Tree, that was crisscrossed with ditches probably from early farming activities. Although the ore from mines in Copper Gulch would have been removed via the Mascotte Tunnel, the waste rock was dumped near the mine portals. Mines in Copper Gulch included Antelope, Blue Jay, Dalton and Lark, Evergreen, Lead, Mayflower, Miners Dream,

Olympia, Richmond, Sampson, Union Flag, Vanderbilt, Washatch, and Yosemite #2. All of the waste rock dumps associated with these mines have now been buried by the Bingham Canyon Waste Rock Dumps.

2. Investigations, Cleanup Activities, and Enforcement Actions:

A summary of investigations and cleanup activities is given in the following table:

TABLE 3
INVESTIGATIONS AND CLEANUPS IN LARK (OU 6)

Date	Activity	Performed by
1986	CERCLA Preliminary Assessment and Site Investigation for State Motorcycle Park and for Lark Tailings determined the existence of elevated concentrations of hazardous substances in the soils of the sites	UDEQ, with funding from USEPA
1988	Kennecott cancels lease with Herriman Irrigation Co. for use of Bingham Tunnel water. State had expressed concern that the water quality was not good enough for irrigation purposes.	UDEQ, Division of Water Quality, and Kennecott
1989	Kennecott (or State) cancels the lease for the State Motorcycle Park due to fugitive dust problems	Kennecott and Utah State Division of Parks and Recreation.
1991	Site-wide CERCLA Consent Degree negotiations begin with EPA, UDEQ, and Kennecott. Listing activities put on hold.	EPA, UDEQ, Kennecott
1993	EPA approves Work Plan for Lark area and cleanup begins with oversight by EPA and UDEQ	Kennecott begins the cleanup
1994	UDEQ conducts study of all watersheds in the area. Included in this study were Midas Creek and Copper Creek. These are PA/SI-like investigations.	UDEQ with funding from EPA
1994	Kennecott begins study of all historic facilities on their property, including Mascotte Pond, Copper Gulch, Midas Silo, and Randolph Peterson Gate. These are PA/SI-like investigations.	Kennecott with oversight by UDEQ
1994	Site-wide negotiations end and EPA proposes the Kennecott South Zone for listing on the NPL	EPA
1995	Cleanup work completed on first phase of Lark removal	Kennecott, EPA
1995	Parties reach agreement to continue cleanups under the provisions of a Memorandum of Understanding. Kennecott agrees to continue cleanups and EPA and UDEQ agree to take no further action regarding listing	EPA, UDEQ, Kennecott

1998	Administrative Order on Consent signed by EPA and Kennecott to cover previous cleanup activities in the Lark area.	Kennecott, EPA
1998	Site expanded to include cleanup of nearby historic facilities including Copper Creek, Mascotte Pond, Midas Silo, Mascotte Tailings, and Lone Tree.	Kennecott, EPA
1998	Final report and all amendments received	Kennecott, EPA
1995, 1998	Final site inspections	Kennecott, EPA, UDEQ
1998	Administrative Order closed out	Kennecott, EPA

C. Community Participation

Because the Lark site is in an unincorporated area of Salt Lake County, EPA gave routine updates on the progress of the cleanups there at the Copperton Community annual meeting. This is because when the former company town of Lark was evacuated, a number of the residents moved to Copperton. There were few, if any, comments on the plans or the cleanups. Following the cleanup, the City of Herrman incorporated and city officials became interested in annexing the area to their city in the future. At this time, part of the site is agricultural land and part open space. The Herriman city officials expressed an interest in the potential of the restored wetland as a centerpiece for a future city open space park.

D. Site Characteristics

1. Size, topography:

Lark is located at the eastern edge of the Oquirrh Mountains in Salt Lake Valley. The site is composed of several waste areas including: Lark Waste Rock (40 acres); Lark Tailings (470 acres); Mascotte Tailings (300 acres); Mascotte Pond (1 acre); Midas Silo (3.5 acres); Copper Creek (10 acres); and Lone Tree (45 acres). The surface water features include Midas Creek (a dry, intermittent stream), Copper Creek (a dry, intermittent stream), and a restored wetland formed by a natural seep in the Lark Tailings area.

2. Surface and subsurface features, areas of archaeological or historical importance

At Lark, there were no surface structures in the clean up area. Before cleanup, there were some retaining walls, old railroad beds, rail trestle ruins, and building foundations, but the structures themselves were long gone. State Highway 111 transects the site. On the western edge of the site was the former town of Lark. All non-mining-related structures had already been removed by Kennecott when the town was evacuated. Most of the roads were removed also and returned to open space. Mining structures built in the 1950s include several former shops now used as warehouses and experimental labs, and an elevated water tank Recently constructed are two above ground leachate collection systems (one for leachate and one for stormwater) which are fed by subsurface cutoff walls and pipelines. In and near Lark are three tunnel portals (Mascotte Tunnel, Bingham Tunnel and Old Bingham Tunnel). Just to the west of the former townsite are the Bingham Canyon Mine Waste Rock Dumps, currently piled with slopes at the angle of repose. One of the dumps towers over Lark to a height of 1000 feet and dominates the landscape. (The potential for a catastrophic slide of these dumps is one of the reasons Kennecott evacuated the people from this area.) There is a “repository” on site. After Kennecott removed the tailings and slimes containing hazardous substances above levels of concern, it

capped the remaining tailings with 6-12" of soil and revegetated. In some areas, tailings are 10-20 feet deep. Future construction on this area would require special considerations to ensure structural stability. There are no waste rock piles remaining on site.

3. Sampling strategy

There were a variety of sampling events at Lark for different objectives. A summary of the events is given in the following table:

TABLE 4
SAMPLING EVENTS AT LARK

SITE	OBJECTIVE	STRATEGY	MEDIA	DATES
Lark Waste Rock	For Listing Package	Grab sample worst case (try to find highest levels)	soils, wastes	1987
Lark Waste Rock	Site characterization	Samples of each pile	soils, wastes	1993
Lark Waste Rock	Post removal confirmation	Grid sampling	soils	1993
Lark Tailing	For Listing Package	Grab samples, worst case	soils, wastes	1987
Lark Tailing	Site characterization	Grid sampling	soils, wastes	1993
Lark Tailing	Post removal confirmation	Grid sampling	soils, wastes	1993
Lark Tailings Seep and Wetland	assessment of possible ground water impacts, effectiveness of wetlands water treatment	periodic inflow and outflow of wetland ponds	wetland and seep waters	ongoing
Addenda to Lark projects, including Mascotte Tailings, Copper Creek, Lone Tree	Site characterization	Grid sampling	soils	1993
Addenda to Lark projects, including Mascotte Tailings, Copper Creek, Lone Tree	Post removal confirmation	Grid Sampling	soils	1994-1996
Midas Creek	Site investigation	Line sampling along course of creek	sediment, soil	1994
Midas Silo	Site characterization	Grid sampling	sediment, soil	1994

Midas Silo	Post removal confirmation	Grid sampling	soil	1996
Copper Creek	Site Investigation	Line sampling along course of creek	sediment, soil	1993-4

4. Known or suspected sources of contamination

The following facilities are known or are suspected to have produced wastes in the Lark area:

TABLE 5
SOURCES OF CONTAMINATION IN LARK (OU6)

Facility	**Waste location**	**Years of operation**	**process used**	**ore**	**volume of waste**	**current status**
Proler	on site	1965-1985	proprietary	tin cans	58,099 tons	total removal
Ohio Copper #1	Lark Tailings	1909-1919	grinding, gravity, later flotation	copper	7-8 million tons	reworked by Ohio Copper #3
Ohio Copper #2	unknown	1923-1937	leach, precipitate	copper	unknown	water is captured by ESCS*
Ohio Copper #3	Lark Tailings	1937-1950	leach, precipitate, flotation	Ohio Copper #1 tailings	7-8 million tons	capped
Fortune Mill	unknown	1900-1909, 1916-1917	unknown	lead, gold, silver, copper	unknown	buried by waste rock
New Mammoth Mill	unknown	1899-1901	cyanide leach	lead, zinc, silver	unknown	buried by waste rock
Dalton and Lark Mill	unknown	1895-1901	unknown	lead, zinc, silver	32,886 tons	buried by waste rock
Mascotte Tunnel	Lark Waste Rock, Midas Creek, Mascotte Ditch, Mascotte Pond, Mascotte Tailings	1901-1952	mine drainage, leachate collection	copper	1.35 million cubic yards (Lark Waste Rock), 10,000 cu. yds (Mascotte Pond), 962 cu. yds (Midas Creek)	flow captured by ESCS*, waste rock moved behind ESCS* with Bingham Mine Waste Rock.

Bingham Tunnel	Same as Mascotte Tunnel, plus Herriman Irrigation Co.	1950-present	mine drainage, access	copper	included in Mascotte Tunnel volumes	same as Mascotte Tunnel
Old Bingham Tunnel	unknown	1901-1907 installed, no ore	distilling during Prohibition	bootleg whiskey	unknown, probably in Mascotte Tunnel volumes	tunnel drainage captured by ESCS*
Copper Gulch Mines	Copper Creek, Copper Gulch Pond, Lone Tree	1871-1885	mining, direct shipment	lead	6423 cy (Copper Creek), 16640 cy (Lone Tree), 60,000 cy (Copper Gulch Pond)	mines buried under waste rock, wastes removed to Bluewater Repository

* East Side Collection System (collects acid mine drainage from waste rock and tunnels associated with the Bingham Canyon Mine)

5. Types of contamination and affected media, types characteristics, quantity concentrations, RCRA Status

There were a variety of different types of mining wastes found at the site. Although many of the wastes contained hazardous substances, they are mostly exempt from RCRA regulation because of the Bevill Exemption. However, EPA applied RCRA regulations wherever they were relevant and appropriate. The types of contamination found at OU 6 are described in the following table:

TABLE 6
TYPES OF CONTAMINATION

Location	**Waste (RCRA status)**	**Quantity**	**Concern**	**concentration**	**Status**
Lark	Waste Rock (solid waste)	2 Million Tons	acid generation potential	Up to 20,000 mg/Kg lead	removed to Bingham Mine Dumps
Lark	Tailings (solid waste)	5 Million Tons	metals	Up to 9560 mg/Kg lead	portion with high metals removed to Bluewater Repository, remainder capped.
Lark	seep	5-8 gpm	sulfate content	about 1200 mg/l sulfate	artificial wetland treatment

Lark	acid soils (soils)	200-300 acres	acidity prevent vegetative growth	not fully characterized	treated with lime, deep tilled, revegetated

6. Location of contamination and routes of migration, lateral and vertical extent, surface and subsurface routes of human or environmental exposure, migration potential, populations ecological and human.

A summary of the locations of the contamination, the potential routes of exposure to human and ecological populations and migration pathways is described in the following table:

TABLE 7
ROUTES OF EXPOSURE, POPULATIONS

Location	**Waste Type**	**Migration Potential**	**Exposure Pathway**	**Ecological populations**	**Human populations**
Lark	Waste Rock	ground water	inadvertent ingestion by industrial workers, ingestion of ground water	elk, deer, cougars, birds observed on site	no residents, 5-10 industrial workers (evidence of trespassing during hunting season)
Lark	Tailing	airborne particulates, surface water transport	inadvertent ingestion by industrial workers	elk, deer, cougars, birds observed on site	no residents 5-10 industrial workers (evidence of trespassing during hunting season)
Lark	Seep	ground water	ingestion of wetland water and ground water	elk, deer, cougars, birds observed on site	no residents 5-10 industrial workers (evidence of trespassing during hunting season)
Lark	Acid Soils	ground water	ingestion of ground water	elk, deer, cougars, birds observed on site	no residents 5-10 industrial workers (evidence of trespassing during hunting season)

7. Ground water

One of the major motivations in the cieanups performed at Lark and South Jordan Evaporation Ponds was to control the sources of sulfate, acids, and metals to the underlying aquifers. The ground water in this area is covered under a previous action, see ROD for OU2, Dec. 13, 2000, and is described in that document.

F. Current and Potential Future Site and Resource Uses:

The land at Lark is currently zoned industrial/mining by the county. There are a few mining support structures on site, but the property owner uses most of the land as a buffer zone between its active mining operations and the valley communities. A portion is leased to local farmers for dry land wheat farming. Most of the land is used for open space and wildlife habitat. The nearest community, Herriman, expressed interest in the land for use as an open space park, using the wetland area as an educational centerpiece.

G. Summary of Site Risks

1. Chemicals of concern:

EPA determined that the chemicals of concern at the Lark site were primarily lead and arsenic. In addition, there were soils and wastes present at the site with high acid generation potential so that transport of sulfates to the groundwater was likely. A summary of lead and arsenic concentrations found in the soils and wastes at the site is given in the following table.

TABLE 8
RANGE OF LEAD AND ARSENIC CONCENTRATIONS
(PRE-REMOVAL CONCENTRATIONS)

Location	**Lead Concentration in Soil (mg/kg)**		**Arsenic Concentration in Soil (mg/kg)**	
	Maximum	Mean	Maximum	Mean
Lark Tailings	9560	2153	790	260
Lark Waste Rock	20,000	9631	296	199
Mascotte Pond	8200	2261	1100	163
Copper Creek	17,000	4949	580	171
Lone Tree	17,000	2348	580	127
Midas Silo	2693	454	142	37
Randolph Peterson Gate	91	91	106	106

Following the removal actions, the range of concentrations dropped as illustrated in the table below:

TABLE 9
LEAD AND ARSENIC IN SOILS FOLLOWING CLEANUP ACTIONS

Location	**Lead Concentration in Soil (mg/kg)**		**Arsenic Concentration in Soil (mg/kg)**	
	Maximum	Mean	Maximum	Mean
Lark Tailings (pre capping)	170	47	120	31
Lark Waste Rock	472	262	39	28
Mascotte Ponds	620	288	45	20
Copper Creek	1240	575	86	35
Lone Tree	232	151	19	11
Midas Silo	175	160	37	31
Randolph Peterson Gate	310	56.8	240	94

H. Removal/Remedial Action Objectives

The Removal/Remedial Action Objectives for this action were as follows:

1. Prevent ground water contamination from uncontrolled releases of acids and metals leached from waste rock piles

2. Prevent exposures of humans to unacceptably high levels of lead and arsenic in soils, based on different exposure rates at different land uses.

3. Prevent downstream migration of unacceptable levels of lead and arsenic in waters used for irrigation by homeowners and farmers.

4. Protect flora and fauna in areas which are prime wildlife habitat.

I. The Selected Remedy

The Removal Action at this Site took the following actions:

1. Excavation of all waste rock piles at the site and disposal at the main waste rock dumps of the Bingham Mine. Unlike the waste rock piles at Lark, the dumps of the Bingham Mine are surrounded by a leachate collection system keyed into bedrock. Consolidation of the waste rock behind the collection system will prevent ground water contamination.

2. Excavation of tailings and slimes with high concentrations of lead and arsenic and disposal in the Bluewater Repository (previously constructed to store mine wastes). This will prevent any direct exposure or inadvertent ingestion by industrial workers, visitors, and wildlife.

3. Consolidation of tailings with low concentrations of lead and arsenic into a central location, cap with topsoil and revegetate. This will keep the more benign tailings from blowing around and creating a nuisance. It will also provide a suitable substrate for vegetative growth.

4. Diversion of any mine drainage effluents into Kennecott’s process water circuit. The contaminated waters from mine drainage contaminated the ground water. The diversion of such waters would prevent further groundwater contamination.

5. Reconstruction of a small wetland. The wetland purifies seep waters and provides habitat.

6. Lime was added to acid soils near Randolph Peterson Gate, mixed into the soil by tilling, and the resultant soils revegetated. This prevented ground water contamination and provided useful soils for wildlife or agriculture.

7. Contaminated sediments were removed from contaminated areas of ephemeral surface streams. This was done to prevent downstream migration.

These removal actions adequately satisfied remedial objectives and EPA has determined that no further action at Lark is needed or required. No Institutional Controls are needed because the waste remaining on site contains only low concentrations of lead and arsenic.

DECISION SUMMARY
SECTION 3: SOUTH JORDAN EVAPORATION PONDS (OU7)

A. Site Name, Location and Description

South Jordan Evaporation Ponds (OU7) includes an area in the western part of the City of South Jordan which was used to store and dispose of excess water from Kennecott's Bingham Canyon mining operations. The waters, which were moderately to severely contaminated, deposited sludges of varying composition before they infiltrated into the ground, evaporated, or were discharged to the Jordan River. The area affected by the ponds was about 1200 acres.

B. Site History and Enforcement Activities

1. Activities at the site which led to contamination

The South Jordan Evaporation Ponds are located on Kennecott property approximately 7 miles east of the Bingham Canyon Mine, 1 mile south of Bingham Creek, 5 miles west of the Jordan River and within the City of South Jordan. Ponds were constructed using waste rock for dikes in about 1936. The ponds were used to store, evaporate, and dispose of excess waters originating from Bingham Canyon mining operations. Because the ponds were built on a former Lake Bonneville delta, the waters soaked into the ground and some of it reappeared in seeps along the face of the delta. Two new ponds (Eastside Seepage Collection Pond and Southside Seepage Collection Pond) had to be constructed there to collect the water.

The amount of water diverted from Bingham Creek to the ponds varied greatly from year to year. Some calculations suggest the average rate was 900 acre-feet/year. Because of the porous nature of the ponds, it is estimated that 80% of the water conveyed to the ponds between 1936 and 1965 seeped into the ground. Evaporation was not the major route of water disposal, despite the name of the ponds.

In 1965 with the opening of the Large Bingham Reservoir, the ponds were supposed to be used only in emergency situations during extremely wet years, mainly as a flood control measure. From 1972 to 1984, untreated Bingham Creek waters entering the ponds averaged 160 acre-feet/year to 1700 acre-feet/year. Lime treatment of the acidic waters began in 1982. After lime treatment began, treated waters entering the ponds ranged from 390 acre-feet/year to 3799 acre-feet/year. In 1983 additional capacity was added and new ponds were constructed. The new ponds were constructed with a clay lining to cut down on the infiltration. One of the older ponds was also reconstructed using clay liners. A 1985 engineering study indicated that there were 182 acres of clay lined ponds, 87 acres of old sludge lined ponds, and 271 acres of unlined ponds, In 1991, Kennecott estimated that there were 3.1 million cubic yards of sludges from lime treatment covering 375 acres, and another 830 acres were contaminated with untreated sludges. By 1991, the ponds were no longer in use and the surface was dry. Occasional complaints about dust clouds were received by the agencies from nearby neighbors.

The South Jordan Evaporation Ponds area was implicated as a source of a plume of ground water containing elevated sulfates (Zone B of Operable Unit 2, addressed in a previous Record of Decision).

2. Investigations, Cleanup Activities, and Enforcement Actions

A summary of investigations and cleanups is given in the following table:

TABLE 10
INVESTIGATIONS AND CLEANUPS AT SOUTH JORDAN EVAPORATION PONDS (OU7)

Date	Activity	Performed by
1991	Site Discovery	EPA
1994	Administrative Order on Consent for removal action	Kennecott, with oversight by EPA and UDEQ
1996	Final report received by the agencies	
1996	Final site inspection	EPA
1997	Close out of removal order	EPA

C. Community Participation

The South Jordan Evaporation Ponds were within the incorporated boundaries of the City of South Jordan, but there was little population that far west of the settled district. In this case, EPA and Kennecott met frequently with the South Jordan City Council, Mayor, and City Manager to discuss the cleanup plans. The city officials were primarily interested in the development potential for the site. During one public meeting at City Hall, people from a neighboring subdivision were pleased that the cleanup was taking place, but were not fond of the back-up beepers on the trucks especially at 3 am. Most of the recent discussions with city officials have involved imminent development plans for the area.

D. Site Characteristics

1. Size, Topography

The South Jordan Evaporation Ponds site is located on a gravel bench in Salt Lake Valley near the Oquirrh Mountains. It is within the corporate boundaries of the City of South Jordan. The area consisted of 375 acres of treated sludge ponds (sludges treated with lime), and 830 acres of untreated sludges and adjacent soils. While the ponds were still active, there was a seep on the downgradient slope of the bench. This seep is no longer active.

2. Surface and Subsurface Features, areas of archaeological or historical importance

At South Jordan Evaporation Ponds, there are no structures on site. There is a 200 acre repository on site which contains non- hazardous sludges. The repository resembles a mesa. Because the sludge would not provide a stable building foundation, it has been designated as open space and recreational land use. A road right-of-way goes through the repository area, but no road has been built there yet.

3. Sampling strategy

The site was characterized prior to the removal action beginning in 1994. Post removal data was provided in the Final Report for the Removal Action.

4. Known or suspected sources of contamination

The major source of contamination at the South Jordan Evaporation Ponds was waste water, mine drainage, and stormwater from Kennecott's Bingham Mine operations. The sludges remaining after the water either evaporated or percolated into the ground was about 3.1 million cubic yards. The ponds themselves were constructed using waste rock. The seeps along the face of the bench originated from waters which percolated into the alluvium and emerged at the surface again downstream.

5. Types of contamination and affected media, type characteristics, quantity, concentrations, RCRA status

There were two types of wastes found at the site: waste rock used to create the dikes for the ponds; and sludges from mining waters. Although either of these types could contain hazardous substances, both are exempt from RCRA regulation because of the Bevill Exemption,

TABLE 11
TYPES OF CONTAMINATION AT SOUTH JORDAN EVAPORATION PONDS

Location	Waste	Quantity	concern	concentration	status
South Jordan Evaporation Ponds	waste rock	not estimated	acid generation potential	not fully characterized - similar to Lark	removed to main Bingham Mine Dumps
South Jordan Evaporation Ponds	sludge, gypsum sludge	3.1 million cubic yards	metals	up to 14,000 mg/kg lead	material with high metals removed to Bluewater Repository, remainder consolidated and capped in an on-site repository.

6. Location of contamination and routes of migration, lateral and vertical extent, surface and subsurface routes of human or environmental exposure, migration potential, populations ecological and human.

The two types of contamination at the site were a threat to human health due to inadvertent ingestion by industrial workers and migration potential of sulfates to ground water. A summary of the exposure pathways is given in the following table.

TABLE 12
ROUTES OF EXPOSURES AND POPULATIONS AFFECTED AT SOUTH JORDAN EVAPORATION PONDS

Location	Waste	Migration potential	Exposure pathway	Ecological populations	Human populations
South Jordan Evaporation Ponds	waste rock	ground water	ingestion of ground water	birds	no residents on site, one industrial worker
South Jordan Evaporation Ponds	sludge	ground water	inadvertent ingestion by industrial workers, ingestion of ground water	birds	no residents on site, one industrial worker

7. Ground water

One of the major motivations in the cleanups performed at Lark and South Jordan Evaporation Ponds was to control the sources of sulfate, acids, and metals to the underlying aquifers. The ground water in this area is covered under a previous action, see ROD for OU2, Dec. 13, 2000, and is described in that document.

F. Current and Potential Future Site and Resource Uses:

At the time the removal action took place, the land at the South Jordan Evaporation Ponds was zoned industrial/mining by the City of South Jordan and Salt Lake County. There were no structures on site. Today, the property owner uses the land for open space and leases a portion of the land to farmers for dry land wheat farming. The property owner is designing a planned community with low and high density residential, commercial, and industrial development. The new community, called Sunrise, has the support of the City of South Jordan and the local residents. The property owner is currently performing geotechnical studies of the on-site repository to determine if the land is suitable for some building.

G. Summary of Site Risks

1. Chemicals of Concern

EPA determined that the chemicals of concern at the S. Jordan Evaporation Ponds site were primarily lead and arsenic. In addition, there were soils and wastes present at the site with high acid generation potential so that transport of sulfates to the groundwater was likely. A summary of lead and arsenic concentrations found in the soils and wastes at the site is given in the following table.

TABLE 13
RANGE OF LEAD AND ARSENIC CONCENTRATIONS AT THE SOUTH JORDAN EVAPORATION PONDS

Location	Lead Concentrations in Soil (mg/kg)		Arsenic Concentrations in Soil (mg/kg)	
	Maximum	Mean	Maximum	Mean
SJEP (Pre-removal)	10,400	207	1330	74
SJEP (Post-removal)	237	93	41	19
19				

Following the removal action, the concentrations of lead and arsenic dropped significantly.

H. Removal/Remedial Action Objectives

The Removal/Remedial Action Objectives for this action were as follows:

1. Prevent ground water contamination from uncontrolled releases of acids and metals leached from waste rock dikes and gypsum sludges

2. Prevent exposures of humans to unacceptably high levels of lead and arsenic in soils and wastes, based on different exposure rates at different land uses.

3. Prevent downstream migration of unacceptable levels of lead, arsenic and sulfate in waters used for irrigation by homeowners and farmers.

4. Protect flora and fauna in areas which are prime wildlife habitat.

I. The Selected Remedy

The Removal Action at this Site took the following actions:

1. Excavation of all waste rock dikes at the site and disposal at the main waste rock dumps of the Bingham Mine. Unlike the waste rock dikes at South Jordan, the dumps of the Bingham Mine are surrounded by a leachate collection system keyed into bedrock. Consolidation of the waste rock behind the collection system will prevent ground water contamination.

2. Excavation of sludges and gypsum sludges with high concentrations of lead and arsenic and disposal in the Bluewater Repository (previously constructed to store mine wastes). This will prevent any direct exposure or inadvertent ingestion by industrial workers, visitors, and wildlife.

3. Consolidation of sludges with low concentrations of lead and arsenic into a central location, cap with topsoil and revegetate. This will keep the more benign sludges from blowing around and creating a nuisance. It will also provide a suitable substrate for vegetative growth.

These removal actions adequately satisfied remedial objectives and EPA has determined that no further action at the South Jordan Evaporation Ponds is needed or required. No Institutional Controls are needed because the wastes remaining on site contain only low levels of lead and arsenic.

DECISION SUMMARY
SECTION 4: BUTTERFIELD MINE, BUTTERFIELD CANYON, AND HERRIMAN (OU3)

A. Site Name, Location and Description

OU3 is composed of several subunits. Butterfield Mine is located in Butterfield Canyon about 2.5 miles upgradient of the mouth of the Canyon. Waste rock from the mine was deposited in the bottom and along the sides of the canyon. Waste rock was found on 14 acres, amounting to about 1.4 million tons. The Butterfield Mine adit has a flow which discharges into the creek. It has a NPDES permit. Butterfield Creek runs through the site.

Also in the Butterfield Canyon area were deposits of tailings left by early milling operations in the canyon. The tailings were also deposited on both sides of the creek. The tailings found at the site amounted to 25,050 cubic yards. Within OU3 are the locations of several mining and milling operations and waste deposits. They are: Revere Mill, Yosemite Mill, Brooklyn Mill, Holt Mill, Queens Mine and Mill, Blackjack Gulch Mines, St. Joes Mine, Yosemite Gulch Mines, Saints Rest Mines, and Water Supply Tunnel Dump.

Located downstream of the Butterfield Mine and Canyon sites is the farming community of Herriman. Herriman residents and farmers have traditionally used the entire flow of Butterfield Creek for irrigation of their crops and lawns. Wastes dumped into the creek upstream were spread throughout the area by the Herriman irrigation system. Eighty-five properties were affected by the contamination within the residential area. Another 238-335 acres of agricultural lands were also contaminated by the irrigation waters.

B. Site History and Enforcement Activities at the Butterfield Mine portion of OU3

1. Activities at the site which led to contamination.

The Butterfield Mining Company began the Butterfield Mine as a lead/zinc/silver mine about 1892. The mine had two portals, the upper portal was the Queen Mine, and the lower the Butterfield Mine. Drainage from both mines exited out of the Butterfield Mine portal. Waste rock from the adits and shafts were dumped along the edges of Butterfield Creek. At some locations, the waste rock was dumped into the creek itself. In the early 1900s, the operators of the mine were sued by Herriman irrigation water users. The water users claimed that the mine was intercepting water which, before mining, fed springs along Butterfield Creek. Not only had the mining company intercepted Herriman water, they had polluted it as well, claimed the irrigators. The court eventually decided that the Herriman water users were entitled to half of the water emanating from the portal of the mine and the mining company the other half.

Later owners, notably the USSRM, extended the adit significantly to intersect with its other adits and shafts. Today the Butterfield Mine adit is 3.5 miles long and intersects with the Niagara Shaft (underneath the Bingham Canyon Pit) and the Bingham Tunnel (which exits at Lark). Mining continued here at least until 1952 by Combined Metals Reduction Company. The tunnel itself was used for operations until the 1960s. The portal of the mine still exists and continues to discharge water. (The discharge is now covered by Kennecott’s Utah Pollutant Discharge Elimination System (UPDES) permit.)

Kennecott estimated that the waste rock deposited in Butterfield Canyon from the mining activities at the Butterfield Mine was about 1.4 million tons and covered about 14.23 acres of the canyon floor.

Beginning in the 1960s, Kennecott began to use the upper reaches of Butterfield Canyon gulches as dumping grounds for its Bingham Canyon Pit Mine waste rock. In general, carbonate rocks were dumped in these gulches. As the aftermath of a leaching experiment, the dumps in the Castro Gulch area blew out and a mud flow

buried the road in the canyon and deposited rock and mud along Butterfield Creek. Active leaching of the dumps near Butterfield Creek stopped after this incident.

2. Investigations, Cleanup Activities, and Enforcement Actions

A summary of investigations and cleanups is given in the following table:

TABLE 14
INVESTIGATIONS AND CLEANUPS AT BUTTERFIELD MINE (OU3)

Date	Activity	Performed by
1991	PA/SI study	UDEQ with funding from EPA
1991	Administrative Order on Consent for removal project, Butterfield Mine Waste Rock (including Castro Gulch Waste Rock)	Kennecott with oversight by EPA
1993	Final Report Received	Kennecott
1993	Final Site Inspection	
1994	Close Out of Administration	EPA

B. Site History and Enforcement Actions at the Butterfield Canyon portion of OU3

1. Activities at the site which led to contamination.

Mineral resources were discovered in Butterfield Canyon in the 1870s, shortly after mining began in earnest in nearby Bingham Canyon. The ores were rich in lead and silver in a carbonate matrix. In addition to the Butterfield Mine described earlier, historical records indicated that there were several other facilities located in Butterfield Canyon and tributary gulches. The first mill in the Canyon was the Revere Mill built in 1875 and expanded in 1878-1880. After this expansion, it specialized in working waste rock and secondary ores. Reportedly, the concentrate it produced had about 50% lead. The tailings contained 3.2% lead.

During this time, the downstream farmers in Herriman sued the mill owners because the mill polluted the creek. Creek water was used in Herriman for irrigation. Eventually the court ordered the mill to stop polluting the creek. There is no record of what monetary damages were awarded to the farmers. There is evidence that the mill owners at least attempted to construct a tailings pond across the creek from the mill.

The mill was bought by the Yosemite Company in 1886, and changed over to a wet concentrator with a capacity of 80 tons/ day. It was also equipped for ore roasting to remove sulfides. By 1887, the mill had been abandoned and apparently burned in about 1890. The mill was apparently rebuilt in 1899, but sources indicate that it burned again in 1900. The Revere Mill was located at the confluence of Butterfield Canyon and Saints Rest Gulch. Deposits of tailings were found on both sides of the creek in that location. During the cleanup activities artifacts of the mill were found including fragments of a wooden flume. There was evidence of fire as well.

Another mill noted in historical records was the Holt Mill located at the mouth of Butterfield Canyon. This mill was erected in 1880 and worked about 2 months on waste rock from the Wasatch and Yosemite mines. Although the suspected location of the mill was sampled, no traces of milling or mining activities were found. Local residents indicate that the flat area at the mouth of the canyon was created in 1950

using soils from nearby hillsides. They suspect than any evidence of milling operations would have been buried.

Two mills in Yosemite Gulch, a tributary of Butterfield Canyon, were mentioned in the records. Yosemite Mine had a mill associated with it, which operated from 1882 to 1886 when the company bought the Revere Mill. The capacity was 40 tons/day. Water for the mill came from the mine. Tailings were apparently dumped into Yosemite Gulch. A trail of tailings was found down the gulch and a significant deposit was found at the confluence of the gulch with Butterfield Canyon. The nearby Brooklyn Mine on Yosemite Gulch also had a mill. No other information is available on its operational history. The original sites of both these mills have been buried by the Bingham Canyon Mine waste rock dumps.

2. Investigations, Cleanup Activities, and Enforcement Actions

A summary of investigations, cleanups and enforcement actions is given in the table:

TABLE 15
INVESTIGATIONS AND CLEANUPS AT BUTTERFIELD CANYON (OU3)

Date	Activity	Performed by
1994	Assessment of on-site historic facilities	Kennecott, with oversight by UDEQ
1997	Administrative Order on Consent, Removal project	Kennecott, with oversight by EPA and UDEQ
Pending	Final site inspection	EPA
Pending	Close out of Removal Order*	EPA

* This ROD does not close out the Removal Project. There are some remaining issues to resolve.

B. Site History and Enforcement Actions at the Herriman Residential Soils and Agricultural Properties portion of OU3

1. Activities at the site which led to contamination

The community of Herriman was settled in about 1851 by Mormon pioneers attracted to the area by ample water supplies provided by Butterfield Creek. Irrigation ditches had been dug by 1852. The relationship between the farmers of the Herriman area and the miners upgradient has always been a rocky one. The disputes always involved either the quality of the water in Butterfield Creek or the quantity or both. Major lawsuits were filed by the Herriman farmers in 1877 and 1908. The farmers sought to augment their irrigation water supplies in Butterfield Creek by importing waters from the Bingham Tunnel and, to a lesser extent, Bingham Creek. Whatever mining wastes were discharged into those waters were spread by the irrigation system all over the area within the town itself and into the surrounding agricultural fields. EPA determined that 85 residential properties, and another 335 acres of agricultural properties had been contaminated by mining wastes in the irrigation system. Particularly high concentrations of wastes were found in historical ditches used at the time of active mining and milling operations upstream. Herriman incorporated as a town in 1999 and became a city in 2001 with a population of 1500.

2. Investigations, Cleanup Activities and Enforcement Actions

A summary of cleanups and enforcement actions is given in the following table.

TABLE 16
INVESTIGATIONS AND CLEANUPS AT HERRIMAN RESIDENTIAL SOILS (OU3)

Date	Activity	Performed by:
1994	Initial assessment	UDEQ with funding from EPA
1996-7	Removal assessment	EPA
1997	Removal project for Herriman Residential Soils, Administrative Order on Consent	EPA with hauling, backfill, and repository services provided by Kennecott
1998	Amendment to Administrative Order to cover another two years of removal activities	EPA with hauling, backfill, and repository services provided by Kennecott
1998	Preliminary assessment of Herriman agricultural properties	EPA
1999	Assessment of Herriman agricultural properties	UDEQ with funding from EPA
Pending	Close out of removal project	EPA

C. Community Participation

Butterfield Mine and Canyon are in an unincorporated area of Salt Lake County, just to the west of the City of Herriman. EPA formed a working group of interested Herriman citizens to discuss site history, site management strategy, and cleanup plans. Citizens aided EPA and Kennecott in locating the sites of historic mills so that sampling could be focused appropriately. The citizens also helped the toxicologists determine the different kinds and frequency of recreational activities that take place in the canyon.

The Herriman working group also helped EPA in locating those areas of Herriman which might have been contaminated. Irrigation officials aided EPA and Kennecott in locating current and historical irrigation ditches and pipelines and indicated which properties might have used contaminated water in the past. The meetings were held at the Lions Club and at various private homes. Key members of this working group eventually applied for and received a Technical Assistance Grant from EPA. They were invaluable in facilitation of discussions about community concerns with EPA and other local agencies. Later on, the TAG group used their grant resources to look at future land uses and determine which kinds of development might be possible on agricultural land near the city. They worked with the maps of contamination, city planners and the property owners to develop a land use plan which was eventually adopted verbatim by the City of Herriman. Communication between city officials and EPA have been extraordinarily strong even when there is a disagreement. The City has used EPA risk assessment calculations to implement its own risk management strategy for future development.

D. Site Characteristics

1. Size, topography

A summary of the geographical and topographic information for OU3 is given in the following table.

TABLE 17
GEOGRAPHICAL AND TOPOGRAPHIC INFORMATION

SITE	LOCATION	SIZE	FEATURES
Butterfield Mine	2.5 miles up Butterfield Canyon on the eastern slopes of the Oquirrh Mountains	Waste Rock deposits = 14.23 acres	Butterfield Creek, Discharge ditch from the mine to the creek with flows of 500 gpm.
Butterfield Canyon	Between Butterfield Mine and mouth of Butterfield Canyon	Saints Rest tailings deposit = 2.87 acres Yosemite Gulch tailings deposit = 2.22 acres	Butterfield Creek, and dry tributary gulches entering from the north (Queen, Butterfield, Olson, Castro, Yosemite, Saints Rest, Black Jack, St. James), several springs and seeps near the creek in upper part (lower part is a losing stream)
Herriman Residential	SW corner of Salt Lake Valley	85 city properties (approximately 46 acres)	Butterfield Creek (dry past irrigation system diversion structure), historic channel obliterated in most spots.
Herriman agricultural lands	SW corner of Salt Lake Valley to the West and North of Herriman settlement	238-335 acres	Butterfield Creek (dry past irrigation system diversion structure), historic channel obliterated in most spots.

2. Surface and Subsurface Features, areas of archaeological or historical importance

At Butterfield Mine, there were no structures remaining an site at the time of cleanup. The Butterfield Mine Tunnel portal still exists on site and still discharges water drained from mining shafts and interconnecting works. One temporary sedimentation pond was installed downstream to trap construction debris. Because the pond attracted wildlife (ducks, deer), and a diversity of wetland plants evolved, this pond was left after construction was completed. Large boulders have been added to restrict vehicular access. A county road open only in the summer transects the site.

At Butterfield Canyon, there were no structures remaining on site. During excavation at the Saints Rest site, a number of artifacts were unearthed. Near the creek were remains of a flume and some plumbing from the old mill. There were also layers of charred wood indicating the site had burned at least once, perhaps more. It is likely that there are more artifacts under the county road which was apparently built on the main site of the mill. Another grouping of artifacts was uncovered farther up the hillside, which according to local residents, was the site of a ranch house. These artifacts were ammunition, pottery, and butchered bones. A county road

and a mining access road transect the site.

High in the canyon are ruins associated with the Queen Mine. The most significant structure is the iron- gated portal to the mine. Debris is scattered about the site. The site is remote and inaccessible to the public.

Herriman, founded in 1851, is a rural community with houses, a church, a civic center (the site of a new city hall), barns, corrals, and associated infrastructure including roads, culinary water pipelines, irrigation water pipelines, sewage pipes, drainage ditches, telephone, electricity, cable and fiber optic cable. The site of historic Fort Herriman was cleaned up, but no artifacts were found. At the time of cleanup, there were no retail businesses in town.

Except for an occasional barn, there are no structures on the Herriman agricultural land part of the site. Portions of the area are criss-crossed with irrigation ditches and pipelines. There are several farms that are irrigated using ground water from wells on site. Others are irrigated using Butterfield Creek water diverted near the mouth of the canyon into a pipeline.

Despite the historic nature of this area, there are no sites on the National Register of Historic Places, nor sites eligible for this register.

3. Sampling strategy

There were a variety of sampling activities performed at the sites covered in this action with different areas and different objectives. A summary is given in the following table:

TABLE 18
SOILS SAMPLING EVENTS AT OU3

SITE	OBJECTIVE	STRATEGY	MEDIA	DATES
Butterfield Mine	For Listing Package	Grab samples, worst case	soils, waste	1991
Butterfield Mine	Site characterization	Grid Sampling	soils, waste	1990
Butterfield Mine	Post removal confirmation	Grid Sampling	soils	1992
Butterfield Mine	NPDES monitoring	periodic grab samples	water (effluent from mine)	ongoing
Butterfield Creek in Butterfield Canyon	Ecological Risk Assessment	Random Sampling	soils, sediment, water	1995
Butterfield Creek in Butterfield Canyon	Site Investigation	Linear sampling down course of creek	soils, sediment, wastes	1997
Butterfield Creek in Butterfield Canyon	Post removal confirmation	Grid sampling	soils	1998
Butterfield Creek in Butterfield Canyon	Post removal AOC compliance	periodic sampling at different locations and at mouth	water, metals in sediment load	ongoing
lower Butterfield Creek	Site Investigation	Linear sampling down course of creek	sediment, soil	1993
Herriman	Site Investigation	random sampling	soil	1993
Herriman	Site Investigation	linear sampling along course of irrigation pipeline and historic ditches	soil	1996
Herriman	Site characterization	composite and random grid sampling of each residential property	soil	1997
Herriman	Post removal confirmation	composite and random grid sampling of each residential property	soil	1997-2000
Herriman agricultural land	Site characterization	course grid sampling (one composite sample per 5 acres), trench sampling in area of historic irrigation ditches	soil	1999
Herriman agricultural land	Site characterization	fine grid sampling (quarter acre grid)	soil	1999

4. Known or suspected sources of contamination

The sources of the contamination in Butterfield Canyon and Herriman are as follows:

TABLE 19
SOURCES OF CONTAMINATION IN BUTTERFIELD CANYON AND HERRIMAN (OU3)

Facility	Waste Location	Years of operation	Process used	Ores	Volumes of wastes	Current Status
Revere Mill	on site, Butterfield Creek, irrigated fields	1875-1900	grinding, gravity separation, cyanide, ore roasting	lead	on site = 25,050 cy	wastes on site removed to Bluewater Repository
Yosemite Mill	on site, Yosemite Gulch, Butterfield Creek, irrigated fields	1882-1888	grinding, gravity separation	lead	at Yosemite confluence with Butterfield Creek (volume included in Revere total)	site buried under waste rock, materials near creek removed to Bluewater Repository
Brooklyn Mill	upper Yosemite Gulch	unknown	unknown	probably lead	unknown	site buried under waste rock
Holt Mill	on site, Butterfield Creek, irrigated fields	1880-1880	grinding, gravity separation	lead	unknown	site buried under alfalfa field at mouth of canyon
Butterfield Mine	on site, Butterfield Creek, irrigated fields	1892-1952	mining, drainage	lead	1.4 million tons	on site waste rock removed next to Bingham Mine Dumps
Bingham Tunnel water lease	pipeline to Butterfield Creek	1952-1987 (water lease)	mine drainage	-	unknown	sediments removed from Dansie land. Rest still there

Bingham Creek	irrigation ditches to agricultural grounds north of Herriman	unknown	water from mine drainage	mixture	unknown	relics of ditch system exist in places
Queen Mine	Black Jack Gulch	same as Butterfield Mine (upper entrance)	mining, waste rock	lead	unknown	waste rock pile still in Black Jack Gulch, detention basin downgulch
Salt Lake County	road base under county roads	unknown	Lark waste rock	lead	unknown	under county roads and sometimes on shoulders

5. Types of contamination and affected media, types, characteristics, quantity, concentrations, RCRA

There were a variety of different types of mining wastes found at the site. Although many of the wastes contained hazardous substances, they are all exempt from RCRA regulation because of the Bevill Exemption. The types of contamination found at OUs 3, 6, and 7 are described in the following table:

TABLE 20
TYPES OF CONTAMINATION

Location	**Waste**	**Quantity**	**Concern**	**Concentration (Surface)**	**Status**
Butterfield Canyon	waste rock	1.4 million tons	metals	Up to 13,900 mg/kg lead	removed to a repository in Castro Gulch behind the stormwater collection system.
Butterfield Canyon	tailings (solid waste)	25050 cubic yards	metals	Up to 65,900 mg/kg lead	removed to Bluewater Repository.
Herriman residential	soils tainted with tailings (soils)	85 properties	metals	Up to >6000 mg/kg lead	removed to Bluewater Repository
Herriman agricultural	soils tainted with tailings (soils)	238-335 acres	metals	Up to 12,595 mg/kg lead	left in place, subject of this ROD.

6. Location of contamination and routes of migration, lateral and vertical extent, surface and subsurface routes of human or environmental exposure, migration potential, populations ecological and human.

A summary of the locations of the contamination, the potential routes of exposure to human and ecological populations and migration pathways is described in the following table:

TABLE 21
ROUTES OF EXPOSURE, POPULATIONS

Location	Waste	Migration potential	Exposure pathway	Ecological populations	Human populations
Butterfield Canyon	waste rock	surface water transport	inadvertent ingestion by water users downstream	deer, elk, birds observed on site	no residents, 2 workers, recreational use during summer and fall
Butterfield Canyon	tailings	surface water transport	inadvertent ingestion by water users downstream	deer, elk, birds observed on site	no residents, 2 workers, recreational use during summer and fall
Herriman residential	soils	none	inadvertent ingestion by young children playing in residential yards	not wildlife habitat	City population is 1500 residents
Herriman agricultural	soils	none	inadvertent ingestion by farmers (adults)	not wildlife habitat, cattle, horses	no residents, estimated 10 active farmers

7. Ground water

The ground water in this area is covered under a previous action, see ROD for OU2, Dec. 13, 2000, and is described in that document.

8. Site specific factors.

Herriman was incorporated as a town in 1999 and became a city in 2001. The zoning in the area of Herriman was instituted some time ago by Salt Lake County, but the City of Herriman is now in the process of developing its own vision of future development. To date, the City has developed its own land use Master Plan and is now discussing its own zoning ordinances and development requirements. They are hoping to mesh their development vision with the agricultural land contamination to minimize the impacts on the community and the property owners using local authorities rather than experience the perceived stigma of Superfund designation. Although growth and development are inevitable in this area, the pressure for development of contaminated lands is low at this point. Of the 66 agricultural properties characterized by EPA and/or UDEQ, only two properties are in current

review by the City and two more were in preliminary discussions. There are no plans for development of the other properties in the near future. Some property owners had a vision of what they would like in terms of future options; others preferred to continue to farm the land for the foreseeable future. At the moment, the development pressure is more intense in the foothills to the south of Main Street.

The site is not eligible for Superfund Remedial Action funding because the site is not on the National Priorities List.

F. Current and Potential Future Site and Resource Uses:

A summary of the land uses at the sites is given in the following table:

TABLE 22
CURRENT AND FUTURE LAND USES

Location	**Zoning**	**Current Land Use**	**Vision of property owner**	**Vision of community**
Butterfield Canyon	industrial/mining	open space	buffer zone, recreational	recreational, tourist attraction
Herriman residential	residential	residential	residential	residential
Herriman agricultural lands	residential (may change in near future with new zoning ordinance)	agricultural	highly variable	mixed land uses (including cluster residential and commercial) including open space and agricultural to enhance rural character of city

G. Summary of Site Risks

1. Chemicals of concern:

EPA and other participating parties worked together to develop exposure scenarios for non- residential land uses at the Kennecott North and South Zone sites. Site specific information, such as speciation and human activities at the site, were used to develop remediation goals for non- residential land uses. Although a variety of metals were assessed, only lead and arsenic proved to be of any concern at the areas covered in this document. In the Herriman area, lead and arsenic concentrations were closely correlated.

Summaries of lead and arsenic concentrations found at the site are given in the following series of tables.

TABLE 23
RANGE OF LEAD AND ARSENIC CONCENTRATIONS
BUTTERFIELD CANYON*

Location	Lead Concentrations in soil or sediment (mg/kg)		Arsenic Concentrations in soil or sediment (mg/kg)	
	Maximum	Mean	Maximum	Mean
Butterfield Mine (pre-removal)	13,900	6643	501	327
Butterfield Mine (post-removal)	550	143	150	31
Queen Mine (wastes left in place)	31,500	8916	3150	1646
Saints Rest Gulch (pre-removal)	65,900	7905	396	68.6
Saints Rest Gulch (post-removal)	1420	362	51	18.2
Yosemite Gulch (pre-removal)	57,900	12,400	819	136
Yosemite Gulch (post-removal)	1230	427	31	15.6
background	118	67.3	23.6	16.3

* wastes were left in place at the Queen Mine because it is in a remote location and migration downstream is prevented by detention basins downstream on Queen Gulch

A summary of the lead concentrations found during the Herriman residential removal is given in the following table:

TABLE 24
LEAD CONCENTRATIONS IN HERRIMAN RESIDENTIAL NEIGHBORHOODS
(percentages of total number of samples collected in the remediated area)

Range of lead concentrations in soil (Herriman residential)	**Pre-removal characterization (surface)**	**Post-removal (pre-capping)**	**Removed soils**
0-400 mg/kg lead	16.8%	17.7%	4.9%
400-800 mg/kg lead	21.6%	22.9%	5.8%
800-1200 mg/kg lead	24.9%	21.7%	14.4%
1200-1600 mg/kg lead	15.4%	13.7%	28.3%
1600-4000 mg/kg lead	15.4%	20.5%	34.1%
4000-10,000 mg/kg lead	5.8%	2.9%	12.7%
>10,000 mg/kg lead	0	0.6%	0

Agricultural lands surround the settled parts of Herriman on the north, east, and west sides. The area was characterized by UDEQ but has not been addressed.

TABLE 25
LEAD IN AGRICULTURAL SOILS NEAR HERRIMAN

Range of lead concentrations	Property-wide averages (%)	Individual samples (%)
0 - 400 mg/kg lead	24.1%	31.5%
400 - 800 mg/kg lead	17.7%	15.2%
800 - 1200 mg/kg lead	14.5%	12.1%
1200 - 1600 mg/kg lead	11.2%	10.2%
1600 - 4000 mg/kg lead	27.4%	24.3%
4000 - 10,000 mg/kg lead	4.8%	6.4%
>10,000 mg/kg lead	0	0.2%

H. Remedial Action Objectives

The Remedial Action Objectives for this action are as follows:

1. Prevent ground water contamination from uncontrolled releases of acids and metals leached from waste rock piles

2. Prevent exposures of humans to unacceptably high levels of lead and arsenic in soils, based on different exposure rates at different land uses.

3. Prevent downstream migration of unacceptable levels of lead and arsenic in waters used for irrigation by homeowners and farmers.

4. Protect flora and fauna in areas which are prime wildlife habitat.

I. Description of Alternatives

A large portion of Operable Unit 3 has already been cleaned up using removal authorities. The selected alternatives for those actions are briefly described in the following table:

TABLE 26
PREVIOUS CLEANUPS WHERE NO FURTHER ACTION IS NEEDED

Area	Waste	Goal	Remedy
Butterfield Canyon	Waste Rock	Prevent human exposure, protect wildlife, prevent downstream migration	Waste rock removed to Castro Gulch, behind leachate collection system, capped and revegetated.
Butterfield Canyon	Tailings	Prevent human exposure, protect wildlife, prevent downstream migration	Tailings removed to Bluewater Repository.
Herriman Residential	Soils contaminated with tailings	Prevent human exposure	Soils removed to Bluewater Repository.

Essentially, all of the actions for areas in Operable Unit 3 have already satisfactorily achieved the Remedial Action Goals, except for the Herriman agricultural properties.

Three alternatives were developed for the only remaining unremediated area, the Herriman agricultural properties. The following is a description of the alternatives:

Alternative 1: No action. This alternative simply means that EPA, UDEQ, the county, and the city leave the agricultural lands surrounding Herriman as they are without any controls regarding any future land use changes. This alternative would inevitably result in a future release of hazardous substances from some properties during construction and create unacceptable exposures to children whose parents might buy such homes. Such an alternative would probably result in an emergency response situation for EPA as each property is developed. This could string out EPA emergency responses for 50 years or longer. There are some real estate ethical standards in Utah which require that property owners notify prospective purchasers of any defect in the property or structure. This notification, however, is not codified into Utah law and the only recourse for a deviation is a private party lawsuit.

Alternative 2: Institutional Controls Only. The strategy of institutional controls is to control inappropriate exposures by controlling land uses and building. Land use controls in Utah are the sole responsibility of the counties and incorporated cities. Typically this occurs by land use planning, zoning, and issuance of building permits. The Herriman agricultural lands are situated in two local jurisdictions: the eastern portions are within the corporate boundaries of the City of Herriman; and the western portions are in unincorporated Salt Lake County. These two local governments have different concerns. In the case of the City of Herriman, a site-specific risk assessment was completed and the preliminary remediation goals were calculated specifically for that area. In the case of Salt Lake County, there are numerous sites in addition to Herriman agricultural lands which require institutional controls. For that reason, the county might want to adopt a county-wide standard and review protocol which would serve the needs of the entire county, not just a small part.

Other types of institutional controls are available, such as deed restrictions, but are not appropriate here because of the large numbers of properties and property

owners impacted.

Specific requirements that the City of Herriman will impose will be developed and adopted by ordinance as a part of the Remedial Design/Remedial Action phase of the project. The City of Herriman has already adopted by ordinance the Land Use and Transportation Elements of its Master Plan, and has established residential land use cleanup goals for lead based on EPA's Endangerment Assessment. Building permit requirements and oversight are being discussed.

Salt Lake County is considering a variety of options for the properties within its jurisdiction, including their current building moratorium, use of the City of Herriman protocols, and development of a county-wide system to address development of contaminated lands.

If the Herriman land use plan and site specific cleanup levels are used, and the soils remain on-site, the costs to developers could be about $8.8 - $13.3 Million (depending on the action level).

Alternative 3: Removal of all contaminated soils from agricultural lands. In this case, all contaminated soils would be removed from the agricultural lands now so that the land would have unrestricted land use should development occur in the future. Since this area is not eligible for NPL listing, no EPA funds can be used for this activity. The only remaining PRPs are the property owners of the agricultural lands. The cleanup costs for the land is estimated at about $62.5 Million assuming that the soils are excavated and hauled off-site to an industrial landfill. This cost does not include substantial transaction costs for EPA enforcement activities.

J. Summary of Comparative Analysis of Alternatives

A chart summarizing each alternative with respect to the nine criteria of the NCP is as follows:

TABLE 27
COMPARATIVE ANALYSIS OF ALTERNATIVES

NCP Criteria	**Alternative 1: no further action**	**Alternative 2: Institutional Controls only**	**Alternative 3: removal of remaining contaminated soils**
Protection of human health and the environment	minimally protective, short term only	minimally protective long term and short term	more protective long term
Compliance with ARARs	complies	complies	complies
Long term effectiveness and permanence	not effective long term	minimally effective long term	effective long term
Reduction of toxicity through treatment	does not treat	does not treat	does not treat
Short term effectiveness	Effective short term	Effective short term	impairs use of the land in the short term for agriculture - current land use
Implementability	no problems	requires cooperation with city and county	requires funding - The site is not eligible for EPA funding. Cleanup would require costly enforcement actions against multiple parties.
Cost	low ($0)	low-medium ($8.8 - $13.3 Million)	high ($62.5 Million)
State acceptance	not acceptable	minimally acceptable	acceptable
Community acceptance	acceptable (not unanimous)	acceptable (not unanimous)	acceptable (if they don't have to pay for it), unacceptable if enforcement on property owners is required.

1. Overall Protection of Human Health and the Environment.

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced or controlled, through treatment, engineering controls, and/or institutional controls.

Since the contamination poses little risk to farmers and ranchers using the Herriman agricultural lands, all three alternatives achieve the goal of protection of human health and the environment in the short term. However, there will be development pressure in the future to convert these agricultural lands into residential, commercial and industrial developments. If and/or when this occurs, Alternative 1

would no longer be protective. Alternative 2 (which requires cleanups to reduce unacceptable exposures specific to that land use) and Alternative 3 (which requires cleanups now to make the land suitable for unrestricted use) would both be effective long term.

2. Compliance with Applicable or Relevant and Appropriate Requirements.

Section 121 (d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as “ARARs” unless such ARARs are waived under CERCLA section 121 (d)(4).

Alternatives 1 and 2 comply with ARARs because there are none. Alternative 3, if chosen, could also be designed to comply with ARARs.

3. Long-Term Effectiveness and Permanence.

Long term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

Alternative 3 is fully protective in the long term because the waste will have been totally removed and unrestricted use would be possible. Alternative 2 is minimally protective long term because it relies on the vigilance of the local government to ensure that the requirements are followed by the developers and property owners. Alternative 1 is not protective long term.

4. Reduction of Toxicity, Mobility, or Volume Through Treatment.

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as a part of a remedy.

None of the Alternatives include treatment as a part of the remedy.

5. Short-term effectiveness.

Short term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

All three alternatives are effective short term while the land remains in agricultural or open space use. However, there are some unfortunate adverse impacts to Alternative 3. Herriman agricultural fields have been in use for up to 150 years and the soils are well suited to their crops. Taking this valuable topsoil away and replacing it with more sterile fill would not only damage the crops during remediation, but could reduce yields for farming, perhaps for years to come. It might actually cause enough economic hardship to force property owners to develop their lands prematurely with a commensurate loss of open space.

6. Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other

governmental entities are also considered.

Alternative 1 can be implemented with ease because it requires no action on the part of either the local or federal government. Alternative 2 can be implemented, but requires the participation of local government. Both the City of Herriman and Salt Lake County have indicated a willingness to participate and most of the property owners will cooperate. Alternative 3 is much more difficult to implement because this site is not eligible for the NPL and federal funding will not be available. Enforcement against property owners would be necessary in order to get the needed funding, This strategy would have high transaction costs, because there are a large number of property owners; the action would require full cleanup even before the future land use is known; and the action would be very unpopular with the community.

7. Cost

Alternative 3 (full cleanup) is the most costly option, estimated at $62.5 Million. The costs associated with Alternative 2 (institutional controls) could not be accurately estimated because it incorporates a great deal of flexibility in both cleanup design and land use. Because some lands are designated as commercial or open space in the future by the Herriman Master Plan, these lands would not need any cleanup at all. Other lands would require only appropriate locations for parking lots. Total costs would be on the order of $8.8 - $13.3 Million, significantly less that full cleanup. Alternative 1 (no action) has no costs (unless enforcement costs after a release are counted). If this cost is included, Alternative 1 could be as costly as Alternative 3.

8. State Acceptance

The Utah Department of Environmental Quality (UDEQ) has some serious concerns over the effectiveness of Alternative 2 to prevent short and long-term exposure to the public from contaminated soil. UDEQ has expressed these concerns during previous reviews of the Risk Management Document and Proposed Plan for this Record of Decision. UDEQ would prefer the complete removal of the contaminated soils in and around Herriman City as this would provide greater protection to the affected residents.

9. Community Acceptance

The community prefers Alternative 3 as well, especially if the federal government (or a nearby mining company) pays for it. If the property owners are responsible for the cleanup, then the community at large prefers Alternative 2. A few property owners who do not like any controls, prefer Alterative 1.

K. Principal Threat Waste

The principal threat wastes at this site were the various piles of waste rock, tailings and sludges which contributed to contamination of soils downstream or contributed to contamination in the downgradient aquifer. The principal threat wastes were all addressed in earlier removal actions typically through excavation and removal to an engineered mine waste repository nearby.

L. Selected Remedy

1. Summary of the Rational for the Selected Remedy

Although Alternative 3, the excavation, removal and disposal alternative, is clearly preferred by the community and the state and has advantages in terms of minimizing long term management by the city and state, its primary problems lie in the fact that it is unimplementable under the CERCLA program without enforcement, and it is

costly. This does not preclude the possibility that some other state program might be enacted that could address this and similar situations in the state.

The reason Alternative 3 would be difficult to implement is that this area is not a part of a listed site on the NPL and therefore is ineligible for Remedial Action funding. The possibility of listing the area on the NPL was explored so that the area would be eligible for EPA fund action, but the calculations revealed that the score would be too low to qualify the site for listing. The other possibility was to take enforcement actions against every property owner with contaminated land on the chance that someday the owner would want to change the land use. This would result in very high transaction costs to EPA because it is clear that some, if not most, of the property owners would refuse to comply. In summary, if faced with the prospect of funding the cleanups themselves now even when development is not imminent, the property owners are much less enthusiastic about this alternative.

Another major problem for Alternative 3 is the cost. Because there are few property owners with any plans for development, a full removal of all the wastes from each property would be required with disposal options limited to off-site industrial landfills. If, however, the property owners wait until development is imminent, the property owners can use on-site options, including, but not limited to, burying the contaminated soils underneath new roads thereby eliminating hauling and disposal costs. Since land preparation is a part of development costs, the cleanups can be accomplished in that step at much lower costs. Implementing Alternative 3 now, perhaps through enforcement actions, would almost force the property owners to sell their land to recoup the costs, thereby eliminating Herriman’s open space buffer.

There are some unfortunate short term problems with Alternative 3. The lands impacted by the contamination have been in agricultural use for up to 150 years. The soils have been conditioned over the years and remain quite productive for both wheat and hay. Excavation and removal of these productive soils with importation of more sterile fill would affect crop yields for several years, perhaps longer. Several property owners have indicated a desire to continue to use their land for farming and have no plans at all to develop their land. But in the process of removing their soils, which they have been trying their best to conserve for years, they would ruin the land for farming. This too might result in premature sale of the land.

After an extreme effort to discover ways to minimize these problems, EPA ultimately rejected Alternative 3 as impracticable under the CERCLA statute.

Alternative 1, the no- action alternative, was the early preference of the property owners. In fact, they initially did not want EPA to even sample the land to determine what was there. In Utah, there are real estate ethical standards which require that property owners and real estate agents disclose all defects in structures and land to any prospective purchaser. The theory here was that what they did not know about their land, they did not have to disclose. This approach would pose a threat to the health of future residents on the land and does not meet the threshold criteria of protection of human health and the environment. All levels of government, federal, state, and local, strongly oppose this alternative, because it provides no consumer protection for future property owners. Most, but not all, citizens agree that this alternative is unacceptable.

Alternative 2, the institutional controls alternative, represents the best remedy for management of the contaminated agricultural lands near the City of Herriman. It is protective, allows the current farming activities on the land to continue, and allows the land to be developed in the future while protecting future residents. In addition, this approach allows cleanup flexibility, different cleanup approaches for different development plans, reduces costs to the property owner and developer, and occurs at a time when development and sale of the property is imminent, thereby allowing each property owner to immediately recoup the costs of the cleanup.

While Alternative 3 must use one cleanup technique for all and one cleanup standard for all, Alternative 2 allows the cleanup to be tailored to each property. Cleanup standards can be variable depending on the land use. Costs to the property owners are minimized while protecting the health of future residents. With a few exceptions, property owners have already begun to work with the city in designing a community land use plan that places commercial developments in areas of contamination. The City has already committed to using its authorities to implement the alternative, if they can get some help in designing their system during Remedial Design.

2. Description of the Selected Remedy

Alternative 2, Institutional Controls, is EPA's Selected Remedy for the Herriman agricultural lands portion of the site. The other parts of the site covered by this Record of Decision have already been addressed. The Selected Remedy for the Herriman agricultural lands includes the following suggested elements.

For the agricultural lands within the incorporated boundaries of the City of Herriman:

- Development of a land use plan for the contaminated agricultural lands which maximizes non-residential land use in accordance with the objectives of the community's vision for future growth needs (this element has already been developed by the Herriman Residents for Responsible Reclamation in conjunction with the property owners and adopted as an appendix to Herriman's Master Plan);

- Passage of a city zoning ordinance which implements the land use plan for the contaminated properties;

- Design of a protocol for review of subdivision applications and site development plans which includes requirements that developers submit plans on how contaminated soils will be managed (in addition to normal elements of site development plans);

- Development of special building permit provisions which specify how contaminated soils unearthed during construction will be managed (in addition to standard provisions of the building permits);

- Passage of a city ordinance or resolution which describes the clean up levels required for different land uses within the city;

- Installation of the necessary information management systems for review and analysis of applications consistent with this remedy.

- Notification of affected public works departments, irrigation companies, and utility infrastructure location services of the locations where contamination is likely to be found in the Herriman.

For the Herriman agricultural lands within unincorporated Salt Lake County:

- Development of a land use plan which maximizes non-residential land use within the contaminated areas to the extent compatible with the land use vision of the county for this area (this has been completed by the Herriman Residents for Responsible Reclamation). The County can choose to adopt this strategy or remain with the current land use plan and zoning;

- Development of site-specific cleanup standards for the Herriman agricultural lands or, alternatively, a county-wide cleanup standard for all lead and arsenic sites in the unincorporated county which can also be used at Herriman.

- Development of site development plan review procedures and building permit requirements. Herriman's review procedures can be adopted if desired.

Note that these elements are suggestions only. The exact provisions are at the discretion of the City of Herriman and Salt Lake County for their respective jurisdictions. The current risks have already been addressed in previous actions. The institutional controls are for use should the land use and exposures change. Five year reviews are needed to evaluate the effectiveness of the controls.

3. Summary of Estimated Remedy Costs

The cost of this remedy to the city, county and future developers can not be reliably estimated at this time, because each remedy and review would be different depending on the size of the development, the use of the land (residential versus commercial, for example), the extent of the contamination, the location of the disposal area, and the cleanup standards used by the city and/ or county. EPA has provided each property owner with a booklet describing the variety of alternatives available and the estimated cost for each approach.

4. Expected Outcomes of the Selected Remedy

The selected remedy was designed to include flexibility for cleanups depending on the land use should development occur. EPA has conducted a site-specific Herriman Endangerment Assessment which produced a PRG range of 1200-1600 mg lead/kg of soil for residential land use. Later, EPA conducted a risk assessment exercise to determine PRGs for non-residential land uses. This document gave a variety of PRGs which depended on activity and land use, bioavailability and other factors.

There are two situations in the Herriman agricultural lands area. A portion of the agricultural lands are within the corporate boundaries of the City of Herriman. They prefer to use action levels using all the site specific assumptions available. The City has already adopted a residential land use clean up standard of 1600 mg/kg lead in soil. Another portion of the agricultural lands are not in an incorporated city and are under the zoning and building permit requirements imposed by Salt Lake County. For this portion, the County has not yet decided what action levels they want to adopt. They could use site-specific conditions in their decision-making or they could choose to adopt a series of county-wide standards. Obviously, site conditions specific to Herriman's situation would be inappropriate for use county-wide. Salt Lake County has numerous mining waste sites, but the speciation varies widely from smelter dust fallout with high bioavailabilities to weathered tailings with low bioavailabilities. In order to be protective for all sites in the county, the PRGs would have to be protective in all locations, not just in Herriman. Table 28 with suggested guidelines therefore presents a range which would cover both situations - the case where the site specific conditions can be considered, and the case which would be protective at all mine waste sites in Salt Lake County.

Table 28 gives guidance on cleanup levels as a function of land use. The City of Herriman and Salt Lake County can use the information in their decision making. Because land use and building controls are a local government function, the choice of cleanup levels is at their discretion. In this table, generally a range is given. Except in the case of the residential land use lead levels, the upper end of the range was derived from assumptions specific to Herriman using bioavailabilities and exposures of lead and arsenic specific to cultivated areas of Herriman. The lower end of the range was calculated using the same exposure assumptions but the bioavailability of lead and arsenic was maximized. The lower end of the range would

apply to all mining waste sites, such as smelter waste and sludges, not just the tailings in the soils of Herriman. This information could be useful if the County wishes to develop county-wide standards which do not make allowances for speciation differences at the various mine waste sites. The residential land use values for lead are simply the range advocated in EPA National Policy and are not site-specific.

TABLE 28
SUGGESTED GUIDELINES FOR USE IN INSTITUTIONAL CONTROLS
TO BE IMPLEMENTED BY THE CITY OF HERRIMAN AND
SALT LAKE COUNTY

LAND USE	LEAD CLEANUP LEVELS (mg/kg lead in soils)	ARSENIC CLEANUP LEVELS (mg/kg arsenic in soils) **4**
Residential, Day Care, and Playgrounds	400 - 1200 **1**	50 **2** - 100 **3**
Commercial (except day-care)	1,500 **2** - 4,000 **5**	250 **2** - 850 **5**
Industrial	1,500 2 - 4,000 **5**	250 **2** - 850 **5**
Recreational/Open Space (except playgrounds)	3,000 **2** - 10,000 **5**	250 **2** - 300 **5**
Agricultural (Herriman site-specific only)	10,000 **5**	300 **5**

1 National Lead Policy Range, effective June, 1997, and 40 CFR Part 475, January, 2001. The site specific Endangerment Assessment for the Herriman Residential Soils Removal Action calculated a preliminary remediation goal range of 1200 - 1600 ppm lead and 100 ppm arsenic for residential soils in Herriman. In 1997, EPA selected 1200 ppm lead as the action level for lead in the Fund lead residential removal action in Herriman EPA acknowledges that a 1600 ppm lead remediation goal already has been established as a clean up goal by a city ordinance in April, 2000, based on the site specific Endangerment Assessment information.
2 Generic cleanup level protective for all mining waste sites in the county absent site specific information.
3 Site Specific to the City of Herriman, based on Herriman Removal Endangerment Assessment calculations performed in March 1997.
4 At Herriman, elevated arsenic levels are seldom present unless it is associated with elevated lead. In this case, elevated arsenic will be addressed as a result of addressing lead. Therefore, a separate arsenic cleanup goal was not developed for Herriman by EPA, nor included in the city ordinance. This is not true county-wide, and both lead and arsenic standards may be necessary.
5 Based on speciation and exposures specific to Herriman, based on calculations from “Preliminary Remediation Goals for Non Residential Land Uses, Kennecott Site”(1999) and “Butterfield Canyon Ecological Risk Assessment (1997). These are calculated based on typical exposure situations and, therefore, may not be protective in unusual or extreme situations.

M. Statutory Determinations

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements, are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous

wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

1. Protection of Human Health and the Environment

The Herriman agricultural lands do not pose a significant risk to human health and the environment because exposures to farmers and ranchers are minor and episodic. The Selected Remedy protects human health and the environment through zoning and the issuance of building permits by local government requiring that future development achieve cleanup standards appropriate to the land use.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The Selected Remedy of Institutional Controls has no specific federal or state ARARs because neither the state nor the federal governments have authority over local land use and building permit requirements. However, to the degree that future developers might wish to build on sensitive habitat (wetlands, for example), local government should warn developers that they could trigger state and/or federal enforcement actions should they ignore regulations which govern these areas. In addition, the movement and disposal of contaminated soils could trigger RCRA subtitle C or D requirements.

3. Cost-Effectiveness

The Selected Remedy is very cost effective because it allows cleanups to occur only when land use changes, if ever, and during the course of land preparation and construction when heavy equipment is already on site. It allows the flexibility to use on- site disposal options, such as underneath roads and parking lots, further reducing hauling and disposal costs.

4. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable.

At full build out, the Selected Remedy would result in fairly permanent solutions because the cleanups would all be appropriate to the land use. Alternative treatment technologies are not precluded in this remedy, but would be unlikely to be used by the property owners who would likely prefer simpler and less costly approaches. In this case, use of alternative technologies is impracticable.

5. Preference for Treatment as a Principal Element

The Selected Remedy does not include treatment as a principal element because it is impracticable at this site given the nature of the contamination. It does not preclude treatment as an option for any future developer who wishes to use this technique to achieve the City and County requirements.

6. Five Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on- site above levels that do not allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

N. Documentation of Significant Changes

The Proposed Plan was released for public comment in April, 2001. It identified Alternative 2, Institutional Controls, as the Preferred Alternative for agricultural soils near Herriman. The Proposed Plan suggested a residential cleanup level range of 1200 - 1600 mg/kg lead in soils for future development of the agricultural lands. Since the Proposed Plan was released for public comment, the range was changed to the non- site specific range of 400 mg/kg - 1200 mg/kg lead in soil to conform with national policy while indicating that the local authorities have the discretion to make their own choices. The guidelines for lead and arsenic were expanded to cover other land uses as well.

RESPONSIVENESS SUMMARY

I. ORAL TESTIM0NY AT PUBLIC HEARING, May 9, 2001

A. Oral Testimony of Mr. Clyde Butterfield.

1. Who is going to take responsibility? Kennecott doesn't want to take responsibility for the contamination.

Answer: Kennecott has taken responsibility for a portion of the contamination and has made a substantial contribution towards the various cleanups in Butterfield canyon and Herriman. Unfortunately, the mining companies responsible for most of the contamination in and near Herriman went out of business years ago.

2. Kennecott has the responsibility to treat the farmers right.

Answer: Under CERCLA, EPA has the authority to hold parties who fit certain categories of liability responsible for cleanup costs associated with such contamination. EPA has and will continue to address Kennecott's responsibility in the Herriman area in an appropriate manner. As this question is directed to Kennecott's responsibility, EPA has provided Kennecott with an opportunity to present its views on the subject in response to this question. The following is Kennecott's response:

"Kennecott has an established record of addressing historic mining wastes that may present a threat to human health and the environment. Kennecott has reported it has spent over $ 5 million participating with EPA in the Herriman removal action and conducting the recent cleanup in Butterfield Creek Canyon.

"Under CERCLA, responsible parties include those persons who generate or dispose of hazardous substances. Additionally, a landowner can be liable for cleanup of hazardous substances on property it owns, even if the landowner did not generate or dispose of the hazardous substance on the property. However, CERCLA liability does not extend to hazardous substances generated and disposed of by prior landowners or operators for whom a party has no liability.

"The record in this case supports the conclusion that over 99% of the lead contamination found in the Herriman area was generated and disposed of by historic mining operations to which Kennecott has no relationship. Decades after the lead ores were milled in Butterfield Canyon and disposed in Butterfield Creek, Kennecott predecessors purchased property in Butterfield Canyon where some of the historic milling and waste rock operations occurred. Kennecott did not conduct the lead mining or milling activities in the Butterfield Canyon and its operations never produced sources of lead which, in and of themselves, would have cause a soil clean up action in the Herriman area.

"In addition to the historic milling and mining operations, historic irrigation practices of the local residents and actions of the Herriman Irrigation Company contributed significantly to the spread of contaminants in the vicinity. The mill tailings and waste rock from the mill operations and the Butterfield Tunnel that entered Butterfield Creek from the lead milling operations were distributed by irrigation ditches to flood-irrigation regions.

"As a landowner where contamination existed, Kennecott undertook two removal projects to cleanup contamination upgradient from Herriman. These included the Butterfield Waste Rock Removal completed in 1994 and the Butterfield Creek Canyon soils removal completed in 1997. Additionally, Kennecott participated in the EPA removal action conducted in Herriman, by providing repository space for disposal of contaminated soils and replacement soils for the properties that were remediated. In 1997 following a significant storm event that washed sediments down Butterfield Creek to the Herriman area, Kennecott promptly cleaned this material from Herriman properties. (The only exception was for one

property owner who refused Kennecott access to conduct the cleanup.)

“No threat to human health and the environment exists on land in the Herriman area that is used for agricultural purposes. However, if the land changes from agricultural to some other land use that requires removal of contaminated soil, Kennecott has indicated it is willing to consider, on a case-by-case basis, allowing the material to be disposed at previously constructed soil repositories on Kennecott property, if such repositories are still open. Kennecott has already done so for other Herriman landowners.”

3. Property owners have right to put a lien on Kennecott property until. Kennecott takes care of their responsibilities. Kennecott bought a contract and they need to pay the debts associated with this contract.

Answer: EPA cannot comment on the property owners legal rights outside of the CERCLA process. Section 107(l) of CERCLA, 42 U. S. C. §4207(l) gives the United States the right to place liens upon property, but does not extend to private parties. EPA cannot respond to the comment regarding Kennecott’s contract because EPA is not familiar with the contract in question.

B. Oral Testimony of Mr. Almon Butterfield

4. Kennecott would like to leave and escape responsibility

Answer: According to Kennecott, Kennecott has no desire to leave the area and wants to continue to mine in the area for some time to come.

5. Kennecott wants to build a new city north of us and they didn’t tell us.

Answer: Kennecott’s plans for their new Sunrise community on their land in South Jordan are no secret. The plans have been discussed with city officials in South Jordan and covered several times in the Salt Lake Tribune and Deseret News.

6. Kennecott cleaned up their own land so they could develop it. They should do the same for the other property owners.

Answer: For some parts of this site, the situation of Kennecott and the other property owners is similar. Kennecott did, in fact, clean up their own lands even though at Lark and Butterfield Canyon they did not dispose of any wastes there This is similar to the situation of the farmers. They simply bought the land, but didn’t generate the wastes. Under CERCLA, current property owners are responsible for contamination on their property, even if they did not cause the contamination.

7. Kennecott stored their waste on our land for 100 years. They should pay a demurrage at $50,000 per acre, for example.

Answer: EPA does not have any information to support the statement regarding the storage of wastes. The appropriateness of a demurrage is outside of EPA's authority. For the sake of clarity, EPA is including a statement from Kennecott on the subject of the question.

“As explained in response to comment number 2, Kennecott did not store their waste on others land for 100 years. The materials that washed onto others land originated from other mining companies, some of which Kennecott eventually purchased. In addition, the irrigation companies have some culpability in the distribution of materials from Butterfield Canyon as they were aware of mining related impacts to the water source but continued to distribute the water regardless.”

8. We should not have to decide now what we might want to do with the land 20 years from now.

Answer: Property owners need not commit to any future land use at this time. This remedy provides for a process that will enable landowners to develop their properties in the future in a safe and cost-effective manner. The cost of the cleanup for any parcel of land will be highly dependent on the use of the land. Waiting until the actual development is imminent has definite advantages in cost savings over trying to do a cleanup without this knowledge.

9. EPA should not walk and allow Kennecott to walk, then make the town fathers deal with it.

Answer: EPA has taken all necessary actions to address the known contamination in and around the town of Herriman. The ongoing controls relating to development, are of the type most often handled at the local level. Federal involvement in such local governmental affairs is typically unwanted. EPA has assisted the local government in developing a process for addressing issues that may arise because of any remaining contamination and EPA will continue to work with the town of Herriman and Salt Lake County to ensure that the controls remain effective, in addition, CERCLA requires that EPA conduct a review every 5 years to ensure that the remedy remains safe and effective, thus EPA will revisit the remedy in Herriman on a regular basis.

C. Oral Testimony of Mr. J. Rodney Dansie

10. In 1997, materials washed down from KUC dumps onto my land, and the materials are still there.

Answer: The lead concentrations in this material are beneath EPA's action level for the removal. However, EPA asked KUCC about this matter. Kennecott responds to this statement as follows:

"Immediately after the storm event, which caused waste rock material to be washed onto Mr. Dansie's land, Kennecott offered to remove the material from the property and restore it to prior conditions. Mr. Dansie declined this offer. Since that time, Mr. Dansie continues to make the statement that the material is still there but forgets to tell people that Kennecott offered to remove the material."

11. The proposal doesn't adequately address aglands. The ditches have never been cleaned.

Answer: Neither EPA nor Kennecott have cleaned out any of the Herriman Irrigation Company ditches. Records indicate that the irrigation company did clean out the ditches on occasion.

12. The lead is still there upstream in the dumps.

Answer: EPA has determined that additional upstream actions are not necessary at this time. The situation is further explained by Kennecott:

"Some waste rock dumps located on Kennecott property may contain varying concentrations of lead. However, these waste rock dumps have a surface water and sediment collection system that is designed to prevent the waste rock and its mineral and chemical constituents from migrating off of Kennecott property. Following the 1997 runoff incident, Kennecott redesigned and constructed new and additional runoff control features designed to contain any runoff."

13. Kennecott accepted liabilities from the land they got.

Answer: Under the CERCLA statute, a party who owns property that is contaminated is responsible for the property that it owns. Off-site releases that occurred prior to a party's ownership of the property cannot be legally attributable to that party, unless the purchaser of the land also buys the company. For further information about CERCLA's liability scheme, you should refer to section 107 (a) of the Comprehensive Environmental

Response, Compensation and Liability Act (CERCLA), 42 U. S. C. 4207(a).

14. Cleanup of their own land should not count toward reducing Kennecott liabilities in Herriman.

Answer: Kennecott’s cleanup of its own land counts towards its liabilities for its own land. Kennecott’s contribution towards the Herriman cleanup counts towards its liabilities relating to the Herriman cleanup. The basis of liability for each area is separate and will be treated as such.

15. EPA shouldn’t put the burden on property owners.

Answer: Section 107 of CERCLA includes current property owners in the category of liable parties. However, in this instance EPA has not taken an enforcement action against the agricultural land owners to require them to clean up their property. EPA has decided that the costs and necessity of cleanup are better addressed when development is imminent. Thus, the property owners may decide for themselves whether it is cost-effective to change the current land use of their property.

16. EPA shouldn't leave with any restrictions on future use of the land.

Answer: EPA does not plan to place any restrictions on land use. Land use decisions are made by local government (city or county). The only time land use becomes an issue is that land use will dictate the amount of cleanup necessary. The HRRR group plan sought to minimize these costs.

17. The county says my damages were $750,000. Kennecott has some responsibility.

Answer: The county’s decision to reduce the property valuation of the Dansie land was for tax purposes. This could allow the property owner to use those tax savings to deal with the contamination. Regarding Kennecott’s responsibility, see Question 2.

18. Kennecott said in a meeting there wouldn’t be any trucks going through town. Kennecott’s trucks went through town.

Answer: Given the location of the staging areas, there was little need for Kennecott’s trucks participating in the cleanup to go through the settled district of Herriman. Truckers under contract or subcontract to EPA were fairly common sights within town however. Since Kennecott often used contracted trucking firms also, it might have been difficult to distinguish from the truck itself if they were working for EPA or for Kennecott. In addition, Kennecott trucks often go back and forth through Herriman to the mine, but this is not related to cleanup activities.

19. The City Council approves because their lands were cleaned up. But they haven’t finished until mine is cleaned up too.

Answer: While EPA cannot speak for City Council, it is very unlikely that the City Council approves of this plan entirely. They, too, would rather not to have to deal with this problem in the future. They recognize, however, that this plan is superior to having the perceived Superfund stigma hang over their city for an indefinite period of time.

20. Kennecott cleaned up Bingham Creek. They should clean up Butterfield Creek too.

Answer: The Kennecott liabilities at Bingham Creek are far different than at Butterfield Creek. At Bingham Creek, Kennecott was actively mining on the headwaters and there are documented accounts that some of the wastes ended up in Bingham Creek. At Butterfield Creek, Kennecott never participated in mining activities. At Butterfield Creek, Kennecott’s liability comes from failure to control dump slides and wastes of others. This resulted in some minor releases, but the major damage had already been done by previous owners.

21. The TAG members are small property owners and they were cleaned up. That is why they support the plan, but the health risk is still there for large property owners.

Answer: Please refer to the comments submitted by the TAG group, Herriman Residents for Responsible Reclamation. These comments indicate that members would rather that the contamination be removed, if there were funds available. Their support of the plan is clearly a second choice because funding from Superfund is not possible.

22. EPA should not leave town until the mining companies comply.

Answer: See Question 9.

23. The TAG group represents EPA and Kennecott not the property owners.

Answer: Given the correspondence that the TAG has written both EPA and Kennecott always seeking information and services in behalf of the citizens, this accusation is totally without merit. They do tend to represent the common interests of the property owns. They do choose their battles and lobby vigorously on those issues which are a concern to most of the property owners.

24. EPA should not have to pay. The owner of the ore body should pay.

Answer: Congress created CERCLA for the purpose of funding cleanups where parties who created the contamination no longer exist, in this particular case, both the limitations of funding and the low level of risk precludes access to EPA funding. Liability under CERCLA is not linked to ownership of ore bodies. Rather it is linked to activities of owners or operators which caused releases of hazardous substances, in this case, the previous landowners were responsible for the major releases, but those parties no longer exist.

25. The mining company has not dealt with property owners openly and fairly.

Answer: If the commenter has specific complaints about Kennecott, those comments should be directed toward Kennecott. EPA does not typically interfere with negotiations between private parties.

26. If you sell dirt, it has to be 500 ppm or less, not 1600. Why?

Answer: UDEQ provided the following response to this question: “Under normal circumstance the agencies (UDERR and EPA) do not involve themselves with simple sand and gravel operations (i.e., setting unrestrictive use standards for contaminant concentrations). However, if a threat of exposure or an actual release of hazardous material were to threaten human health or the environment, UDERR and EPA would investigate to prevent the threat or pursue a cleanup of said threat. Without specific controls over where soil or gravel may be exported to, the owner/operator of the operation and the property owner could potentially be considered responsible parties and subject to future liability for cleanup of any health threat caused by their actions.

“In the past, soil exportation operations at some remediation sites have had unrestrictive use standards set at conservative concentrations for contaminants of concern. Recently both agencies agreed to an unrestrictive use standard for the proposed sand and gravel operation in Black Rock Canyon, with a lead concentration of 500 ppm and an arsenic concentration of 50 ppm. The reason for these lead and arsenic concentrations is because there is no control over where the soil or gravel will be exported to and what the material will be used for.

“UDERR and EPA strongly suggest that all precautions be taken to prevent an actual release or threat of release of contaminated soil above the lead and arsenic concentrations stated above.

27. HIC was fair and shared records with EPA. EPA should return the favor by helping getting our lands cleaned up.

Answer: EPA appreciates the knowledge and expertise of the board members of the HIC (Herriman Irrigation Company). Access to their historic records saved the government substantial amounts of money in its investigations because the maps allowed EPA to go directly to the area of the waste rather than searching for it in more laborious ways. The HIC should be aware that EPA had the legal authority to compel release of the company records, with or without the cooperation of the company.

28. About 15 - 20 acres of aglands were cleaned up as a part of the residential cleanup. What about the rest of the aglands.

Answer: Some lands used for agricultural purposes were cleaned up as part of the residential cleanup. EPA's criteria as to what was residential land and what was agricultural land was stated quite clearly from the beginning. Vacant lots or corrals within the settled district, areas adjacent to the community with imminent development plans, and areas where contamination could wash downstream were cleaned up. Agricultural lands outside the settled district were not cleaned up in either the Bingham Creek area or near Herriman. The definition of agricultural lands was established at the earlier Bingham Creek cleanup and was used again at Herriman.

29. Rio Tinto should not turn backs on neighbors, not fair, not moral.

Answer: CERCLA can only deal with legal liabilities.

30. EPA implied we would be made whole when we first started.

Answer: EPA made an effort to make sure that the properties it cleaned up were equivalent or better than what was there when we started. At the time the residential cleanups were going on, it was clear that EPA would not be able to do much about the agricultural lands. That is the reason why the agricultural property owners requested that EPA not sample their lands. EPA complied with this request. It was only when the county building moratorium was instituted that the owners wanted EPA to sample their lands. We complied with this request also. EPA has made every effort to treat property owners fairly and equitably.

31. EPA should deal with us like we dealt with them. We gave them information and we gave them access. We could have kicked them out.

Answer: Of course, EPA appreciated both the information and the access given voluntarily. EPA did have the right to compel this, but didn't find it necessary to exercise this authority. However, dealings with the citizens of Herriman did not always go smoothly. There were numerous instances of name-calling and other forms of verbal abuse which government employees largely ignored. There were also instances of citizens who attempted to reap a windfall at government expense by telling half-truths about their development plans. Despite this treatment, EPA endeavored to treat the residents with honesty and respect.

32. Put close out on hold until money is available. Don't let Kennecott off the hook until they comply.

Answer: Kennecott is in compliance with all requests that EPA has made with respect to the Herriman cleanup. EPA has selected a remedy for the agricultural lands that addresses the risks in accordance with the criteria set out in CERCLA. It is unlikely that additional funding would ever be available because of the low level of risk present in the agricultural properties.

33. Don't shift burden to the city.

Answer: The city government is the best equipped to make the development and land use decisions. This is a normal function of city government. The added complication of contamination on some properties is small relative to the decisions made during the course of normal development plan reviews and building permit issuance.

34. Putting restrictions on land is like a public taking.

Answer: Land use restrictions are a common part of modern life. EPA does not plan to put any restrictions on the land. The future use of the land will dictate the degree of cleanup necessary at the time of development.

35. Put restrictions on the land only short term until the money for cleanup is available.

Answer: This suggestion would essentially stop all development in the contaminated agricultural lands and would unnecessarily restrict property owners. Since it is unlikely that funding will ever be available, this approach would be unacceptable to most property owners.

36. KUC should not be let off the hook because KUC and everyone else has known about this for 30 years. They did it with knowledge.

Answer: EPA agrees that it was common knowledge that the water coming down Butterfield Creek was contaminated in the old days. There are notations of this problem in the Irrigation Company records, and a variety of legal actions. There is also evidence that the mining companies in operation at that time also knew of the problem because they insisted that the irrigation company and other water users sign indemnification agreements which essentially meant that they could have the water without any guarantees of “quantity or quality”. The property owners wanted the water even though it was off-colored.

37. Tailings disposal is a normal cost of doing mining.

Answer: EPA agrees. Unfortunately, the early miners chose to minimize their costs for tailings disposal by dumping the tailings close to their mills which were typically on waterways. These mining companies are no longer around.

38. Commercial establishments might not want to use contaminated land.

Answer: Commercial establishments are becoming more and more comfortable about redeveloping contaminated land. This typically depends on the location. Redevelopment or former railyards is an example - the Gateway Project in downtown Salt Lake City, and Coors Field in downtown Denver are but two famous examples of this. Home Depot is active in this area as well. Land zoned for commercial or industrial activities is fairly rare in the suburbs and such lands are typically in high demand.

39. I didn’t put tailings on my land. I shouldn’t have to pay to clean it up.

Answer: At Lark, Kennecott didn’t put tailings on the land either, but, as a property owner, did clean it up.

40. Conditions haven’t changed. It’s still coming down the creek.

Answer: The monitoring data suggests otherwise.

41. I am asking for the help of the state legislature, state engineer, DEQ and Salt Lake County.

Answer: This action was performed solely under the authorities of CERCLA. The certainly doesn’t preclude the involvement of other governmental actions and regulations.

42. If I could take your 401k, you’d be yelling too.

Answer: Probably.

II. WRITTEN COMMENTS RECEIVED BY MAIL AND E-MAIL

A. Comments from the Herriman Residents for Responsible Reclamation (HRRR)

43. There are some issues remaining from the residential reclamation. EPA should re-examine its final punch lists.

Answer: EPA agrees.

44. The Sidwell Numbers are incorrect on EPA correspondence involving at least 11 properties. The correspondence should be corrected.

Answer: EPA agrees.

45. The HRRR “Preferred Land Use Plan” was adopted by the City Council of Herriman on June 21, 2001.

Answer: Noted.

46. The majority of the agricultural property owners supported the land use plan, but this was because no other options were available. The preference of all would have been full cleanup of the agricultural lands.

Answer: CERCLA authorities are limited in what they can do with regard to agricultural land cleanup. This does not preclude other governmental agencies from taking action if they so choose.

47. Economic impact to the agricultural landowners, in addition to health impacts, should be considered by EPA.

Answer: The National Contingency Plan does consider cost effectiveness as one of its criteria, but reduction of risk is the primary criteria. In terms of cost effectiveness, costs are far more reasonable when the cleanups are designed with the specific development in mind. For example, contaminated soils can be capped by new roads when the location of the new roads are known. Today, the soils would have to be completely removed from the property. This costs extra in hauling and disposal fees. In addition, EPA did consider the economic impact of making the owners of the agricultural land pay for the cleanup before they make land use decisions, in this case, EPA decided that it would impose too great a burden on the property owners to force them to pay for a cleanup that may not be necessary.

48. Partial clean letters should be written by EPA for those agricultural lands where a portion of the land is clean, so that these lands can be freed up for future development.

Answer: EPA agrees.

49. HRRR finds the lack of agreement between the agencies on the appropriate action level for residential development particularly unsettling.

Answer: EPA agrees.

50. EPA and UDEQ should come to agreement on the action level, and the City of Herriman and Salt Lake County should be involved in the decision making process.

Answer: EPA agrees and has suggested mediation of this dispute with all parties present. As of April, 2001, UDEQ has chosen to approach this differently.

51. The TAG grants are particularly useful and the program should be continued.

Answer: EPA agrees.

B. Comments of P. West, Clearfield UT

52. Residents of Herriman left with a legacy of contamination.

Answer: EPA agrees.

53. Zoning laws will fail short term because children may wander into open space lands not used for farming.

Answer: This may occur on occasion, but it is not likely because the fields are fenced, usually with barbed wire. The greatest risk from lead is to children under 6 years of age. It is unlikely that children in that age range will be able to get through the fencing to the contaminated fields.

54. Zoning laws will fail long term because of local government turnover and economic pressure.

Answer: Because the alternatives to zoning (EPA enforcement on each property owner) are so unpleasant, there is a strong incentive for the zoning approach to succeed in this case. In addition, EPA will continue to monitor the progress of the zoning in its 5 year review process.

55. Giving a range is inappropriate, lending support to the higher value chosen by the local government. Error on the side of caution would be more prudent.

Answer: The IEUBK model is designed to produce a conservative result because assumed exposures are on the high end of the continuum. Both the numbers in the range are therefore conservative. The choice of the actual value is therefore a risk management decision which should be made by the governmental body doing the enforcing. In this case, the City of Herriman chose to adopt the higher value. The value is still protective because of the conservative assumptions within the model itself, but is balanced by a desire on the part of the city to minimize economic impacts to its citizens. Overprotection comes with a cost.

56. Property owners used the water, but may not have known it was contaminated. Kennecott should not be allowed to walk away from a problem that they inherited or caused. Property owners and Kennecott should share the costs of remediation.

Answer: The CERCLA statute, although rather broad, states that the owner/operator at the time of release is a liable party. The data suggest that the major releases downstream occurred before Kennecott owned any of the land. The purchase of the land itself brings liability only for that land, not for prior releases. If Kennecott had bought not only the land but the mining companies as well, then they would be fully liable. Such was not the case in this situation. The property owners can deal with the situation if they want to change the land use at the time this occurs. This gives them flexibility to explore on-site options at a much reduced cost.

57. Horses could be exposed to hot spots within agricultural zones.

Answer: There are several factors why this problem is unlikely to be a significant issue. (1) Horse exposures are calculated on the basis of the size of the pasture. In this case, hot spots within a pasture unit are relatively small. (2) None of the horse owners have reported a problem with their horses in this area. The last reported problem with horses occurred during the time active mining was taking place in the 1870s. At that time, the horses were probably drinking the contaminated water. (3) The 2500 ppm lead mark in the Butterfield Canyon ecological risk study was based on a horse ingesting soil in the process of grazing. It came from a NOAEL (No Observable Adverse Effects Level) value. The LOAEL (Lowest Observed Adverse Effects Level) for horses is actually 10.8 times higher.

This would translate to a soil level of 27,000 ppm as the level where effects begin to be observed. (4) Additional factors include the observation that horse owners supplement their horse diet with hay and oats and the values given in the ecorisk document are not corrected for bioavailability. It should be pointed out that quite a few horse corrals were already remediated during the Herriman residential project.

58. General land use scenarios inappropriate. Examples are: (1) a child who farms by hand in a portion of the father's land; (2) ATV riders with kids riding along.

Answer: The activities considered by the toxicologists were those mentioned by the Herriman residents as common activities in the Herriman - Butterfield Canyon area. The two scenarios given here did not come up during these discussions or in the Kennecott Risk Assessment Task Force.(1) The child who “farms” on his father’s land is likely to do so in the home garden. The home gardens in Herriman have already been remediated. (2) ATV use was identified as the recreational activity leading to the most potential exposure of all the recreational activities practiced by Herriman residents. Even if young children below the age of 6 do ride with their parents on an ATV, the exposure is likely to be on the order of 0. 12 mg of lead/day if the soil contains 10,000 mg Pb/kg soil. For comparison, this is also the exposure expected from playing outside in the backyard with residential soils at 1200 mg Pb/kg soil. Because the concentrations of soils in the open spaces near Herriman average much less than this, this would have to be considered to be the worst case scenario.

59. How can one activity be used to describe an entire land use?

Answer: The toxicologists calculated the exposures expected from a wide variety of activities for each land use. For the recreational land use, the following activities were evaluated: ATV, horseback riding, hiking, camping, picnics (lunch breaks) and hunting, There were two possible strategies: use of exposure rates for the most popular activity, or use of the exposure rates for the activity producing the highest exposures. The most popular activity (according to a survey of Herriman residents conducted for the Kennecott Risk Assessment Task Force) was picnicking. Of the recreational activities, ATV use produced the highest exposures (although none of the Herriman residents reported this as an activity they did in Butterfield Canyon). Choosing the more conservative approach, EPA therefore used ATV riding to calculate the recreational land use guideline, assuming that if the exposures were acceptable for that use, it would be acceptable for all the other activities which had lower exposures. The same strategy was used for the industrial and commercial land uses as well.

60. What happens during plowing when a subdivision abuts the agland?

Answer: Since plowing occurs only once or twice a year, the dusts produced by this activity would not significantly impact exposures. The Herriman blood lead study confirmed that lead in indoor dust is quite low.

61. EPA Region VIII, property owners, and Kennecott have responsibility to complete a removal or provide short term security before development.

Answer: CERCLA imposes some limits on EPA authority, and EPA has used those authorities to the maximum extent possible within the legal framework. This does not preclude other statutes and or programs (without such limitations) from stepping in to augment the cleanup. At other sites, state funding has been suggested to accomplish this. No such effort has been made by the state thus far.

62. The contamination should be removed now before a release occurs.

Answer: This suggestion is virtually impossible without listing the site, and the site does not score high enough to be listed. Again, other programs, perhaps funded by the state, could step in if they so choose.